(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－95611

(43)公開日　平成11年(1999)４月９日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｇ０３Ｇ　15/20	１０９	Ｇ０３Ｇ　15/20	１０９
Ｇ０５Ｆ　1/455		Ｇ０５Ｆ　1/455	Ｂ

審査請求　未請求　請求項の数10　ＦＤ　（全 11 頁）

(21)出願番号　特願平9－272107

(22)出願日　平成９年(1997)９月18日

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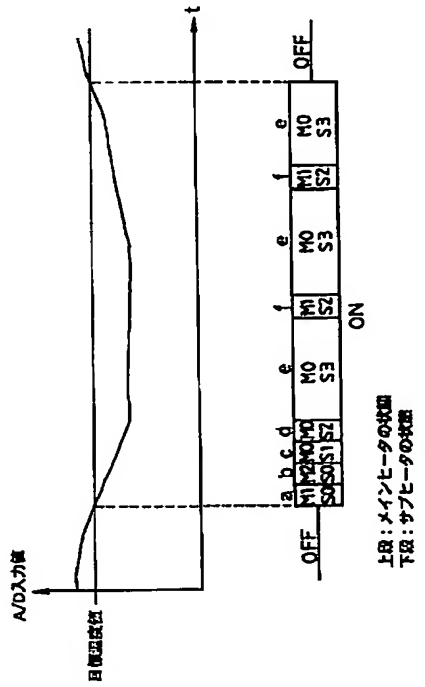
(54)【発明の名称】　定着ヒータの制御方法および画像形成装置

(57)【要約】

【課題】位相制御によらず、定着ヒータによる急激な電流変化を低減することができる定着ヒータの制御方法およびこれを採用した画像形成装置を提供する。

【解決手段】ヒータ温度が目標温度より低下したときの交流電源電圧の印加開始直後に、ヒータ電流を減少させるために、定着ヒータへ印加する交流電源電圧の３半波長分を周期として、間引き数を大から小に変化させていく。２つのヒータを有する場合には、それぞれについて順次これを行う（状態ａ，ｂ，ｃ，ｄ）。その後、間引き数を０とした印加を行う。この際も、連続する３半波長分を周期として、第１のヒータには１周期の３半波長のうちの１半波長または２半波長分の波形を間引いて通電すると共に第２のヒータには第１のヒータで間引いた半波長分のみの波形を印加する第１の通電パターンを用いる状態ｆと、一方のヒータにのみ通電する状態ｅ（または状態ｆの両ヒータの関係を逆にした状態）とを、ヒータ温度が目標温度に達するまで、交互に繰り返す。



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【特許請求の範囲】

【請求項１】定着ヒータへ印加する交流電源電圧の少なくとも連続する３半波長分を周期として、そのうちの１または複数の半波長分の波形を間引く制御を採用し、

前記定着ヒータへの交流電源電圧の印加開始直後に、前記定着ヒータに対して前記間引き制御による間引き波形を印加した後、間引きのない波形の印加へ移行することを特徴とする定着ヒータの制御方法。

【請求項２】請求項１に記載の方法であって、３半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数２として複数周期の印加を行い、その後、間引き数０の印加へ移行する定着ヒータの制御方法。

【請求項３】請求項１に記載の方法であって、前記交流電源電圧の印加開始直後に、間引き数を大から小に変化させた後、間引き数０とする定着ヒータの制御方法。

【請求項４】請求項３に記載の方法であって、３半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数２として複数周期の印加を行い、ついで、間引き数を１として複数周期の印加を行い、その後、間引き数０の印加へ移行する定着ヒータの制御方法。

【請求項５】請求項１に記載の方法であって、前記定着ヒータは、第１のヒータと第２のヒータとからなり、

前記第１のヒータと第２のヒータに対して交互に通電する際、連続する３半波長分を周期として、第１のヒータには１周期の３半波長のうちの１半波長または２半波長分の波形を間引いて通電し、第２のヒータには第１のヒータで間引いた半波長分のみの波形を印加する定着ヒータの制御方法。

【請求項６】請求項５に記載の方法であって、請求項５に記載の第１および第２のヒータへの第１の通電パターンと、第１および第２のヒータの関係を逆にした第２の通電パターンとを交互に切り替える定着ヒータの制御方法。

【請求項７】請求項６に記載の方法であって、第１のヒータに対するNm個の半波長の連続印加と、第２のヒータに対するNs個の半波長の連続印加とを交互に繰り返す制御と等価な制御として、２Ns－Nm個の半波長分、前記第１の通電パターンで第１および第２のヒータへの通電を行い、ついで、２Nm－Ns個の半波長分前記第２の通電パターンで第１および第２のヒータへの通電を行うことを交互に繰り返すことを特徴とする定着ヒータの制御方法。

【請求項８】請求項５に記載の方法であって、請求項５に記載の第１および第２のヒータへの第１の通電パターンと、第１および第２のヒータの一方のみへの間引き数０の通電とを交互に切り替える定着ヒータの制御方法。

【請求項９】トナー像を用紙上に定着させる定着器を有する画像形成装置であって、

前記定着器の定着ヒータとしての第１および第２のヒータと、

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該第１および第２のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第１および第２のスイッチング手段と、

該第１および第２のスイッチング手段のスイッチングを制御する第１および第２のスイッチング手段と、

前記定着ヒータのヒータ温度を検出する温度検出手段と、

交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、

前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第１および第２のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第１および第２のスイッチング手段を制御する制御手段とを備えたことを特徴とする画像形成装置。

【請求項１０】請求項９記載の画像形成装置において、前記第１のヒータと第２のヒータとは、発熱強度の分布を異にすることを特徴とする画像形成装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、静電式複写機、プリンタ等の画像形成装置に係り、特に、その定着ヒータのＯＮ／ＯＦＦによる突入電流を含めた電流の変動を低減させるそのヒータ制御方法に関するものである。

【０００２】

【従来の技術】従来、この種の定着ヒータには比較的消費電流の大きいハロゲンランプが使用されており、そのＯＮ時には非常に大きな突入電流の発生がある。特に、ハロゲンヒータの特性上、ハロゲンヒータ自身の温度が高いときはその抵抗値が大きく、低いときには抵抗値が小さくなる。通常、ヒータ温度が予め定められた温度より低くなった場合にハロゲンヒータを点灯するので、点灯直後には大きな突入電流が流れることになる。

【０００３】図５に電圧変動説明図を示す。一般的に、電源コンセント側から供給電源を見た場合、比較的小さな電源インピーダンス（Rs）７が存在する。このため、電源に接続された機器（ここでは、複写機）の消費電流Ｉが大きく急に変化したときは、電源電圧Ｖの変動が発生し、その大きさは、急激な電流変化を△Ｉとすれば、急激な電源変動分は△Ｖ＝Ｒｓ×△Ｉと評価できる。例えば、このコンセントラインに照明器具９が接続されていれば、急激な電圧変動は照明のチラツキとなって現れてくる。

【０００４】

【発明が解決しようとする課題】ここで、具体的な定着器の構成に関連して、本発明の課題を説明する。

【０００５】図１は、本発明が適用される定着器の概略図であり、この中の１はヒータローラ、２は加圧ローラを表わす。この両ローラ１，２間に、トナー画像が現像

された用紙３を通過させることにより、トナー画像を用紙３上に熱融着させることができる。ヒータローラ１内には、メインヒータ４とサブヒータ５が図示された形で装着されている。

【０００６】すなわち、図２に示すように、メインヒータ４の発熱強度分布は中央付近にピークがあり（図２Ａ）、一方、サブヒータ５は両端部側にピークがある（図２Ｂ）。この２本のヒータを交互に点灯させ、そして各ヒータの点灯時間を調節することで、ローラ表面上での温度分布を均一化させる（図２Ｃ）。

【０００７】図３はスタンバイ時のヒータへの通電電流波形を示すが、この中でＰ１は大きな電流変化がある部分である。図５で前述したように、この電流変化が、供給電源そのものの電圧変動を生じさせ、同一電源に接続されている照明等のチラツキなどの弊害を引き起こしてきた。近年、このような機器の電流変化による電圧変動を低減させようという社会的な要請が強まっている。

【０００８】画像形成装置の定着器に使用されるハロゲンヒータによる急激な電流変化を低減するための方法を、本発明は提供するものであるが、具体的には、図３内に示された以下の急激な電流変化部分を緩和することである。

【０００９】１、　ハロゲンヒータの突入電流部（図３内のＰ１，Ｐ２部）

２、　２本ヒータ構成の定着器でヒータを交互に切り替えたときの電流変動部（図３内のＰ３，Ｐ４）

このような問題点を解決するために、図４に示す様な位相制御によるヒータへの通電が考えられる。ヒータＯＮ直後の突入電流発生時のような急激な電圧変動防止には、電圧の実効的な大きさを徐々に大きくしていけば良いから、例えば図４内メインヒータ４への通電波形に示した形で、まず、１半波長内の通電時間を、ｔｍ１，ｔｍ２，ｔｍ３，…，ｔｍｃへと徐々に、拡大していけば良い。サブヒータ５についても同様にｔｓ１，ｔｓ２，ｔｓ３，…，ｔｓｃとする。この中で、メインヒータ４の定常状態通電位相角に相当するｔｍｃおよびサブヒータ５のｔｓｃは、一定値である。

【００１０】この値は、図３内の切り替え波形に戻って考えると、この場合のメインヒータ４の通電電力はＴｍ／Ｔ、サブヒータはＴｓ／Ｔの割合であるので、この値に従ってｔｍｃ，ｔｓｃを調整することが可能である。

【００１１】このような構成により、事実、理想に近い穏やかな電流変化をさせることも可能である。しかし、この方法には、以下の様な欠点も存在する。

【００１２】１、位相角（即ち、上述ｔｍｃ，ｔｓｃなどの時間）を決めるためのタイマ機構など、そのハードウェアが複雑であること、そして、それらの設定、起動などの制御上の複雑性も同様に高くなると考えられる。

【００１３】２、電源周波数の異なる地域（５０Ｈｚ，６０Ｈｚの地域差）に対しては、各々別の設定をしなければならず、その切り分けに対する管理上の煩雑さを生ずる。

【００１４】３、図４を見ても明らかな様に、ヒータへの通電がゼロクロス起点ではなく、半波長内の中間でＯＮされているため、高調波電流の発生という弊害を生み出す。この高調波電流は、電源周波数の高次波（数倍～数十倍）で発生し、これは給電線を通して接続された他の機器へ、ノイズとして妨害を与え、誤動作、故障の原因となる。従って、位相制御の場合には、この電源高調波電流を低減するため、別途、大容量のチョークコイルを挿入する、等の対応が必要となっている。

【００１５】本発明は、このような問題点に鑑み、これを克服できる方法を提案するものである。すなわち、本発明は、位相制御によらず、定着ヒータによる急激な電流変化を低減することができる定着ヒータの制御方法およびこれを採用した画像形成装置を提供するものである。

【００１６】

【課題を解決するための手段】本発明による定着ヒータの制御方法は、定着ヒータへ印加する交流電源電圧の少なくとも連続する３半波長分を周期として、そのうちの１または複数の半波長分の波形を間引く制御を採用し、前記定着ヒータへの交流電源電圧の印加開始直後に、前記定着ヒータに対して前記間引き制御による間引き波形を印加した後、間引きのない波形の印加へ移行することを特徴とする。

【００１７】これによって、定着ヒータへの交流電源電圧の印加開始直後の突入電流の発生を防止することができる。また、位相制御によらず、ヒータ電流がゼロクロス起点から印加されるため、電源ライン上における電源高調波の発生を殆どなくすとともに、制御ハードウェアを比較的単純化することができる。

【００１８】具体的には、３半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数２として複数周期の印加を行い、その後、間引き数０の印加へ移行する。

【００１９】他の見地によれば、本発明の方法は、前記交流電源電圧の印加開始直後に、間引き数を大から小に変化させた後、間引き数０とするものである。

【００２０】例えば、３半波長分を周期として、前記交流電源電圧の印加開始直後に、間引き数２として複数周期の印加を行い、ついで、間引き数を１として複数周期の印加を行い、その後、間引き数０の印加へ移行する。

【００２１】前記定着ヒータが、第１のヒータと第２のヒータとからなる場合、前記第１のヒータと第２のヒータに対して交互に通電する際、連続する３半波長分を周期として、第１のヒータには１周期の３半波長のうちの１半波長または２半波長分の波形を間引いて通電し、第２のヒータには第１のヒータで間引いた半波長分のみの波形を印加する。

【００２２】この場合、例えば、このような第１および第２のヒータへの第１の通電パターンと、第１および第２のヒータの関係を逆にした第２の通電パターンとを交互に切り替える。

【００２３】具体的には、第１のヒータに対するNm個の半波長の連続印加と、第２のヒータに対するNs個の半波長の連続印加とを交互に繰り返す制御と等価な制御として、２Ns－Nm個の半波長分、前記第１の通電パターンで第１および第２のヒータへの通電を行い、ついで、２Nm－Ns個の半波長分前記第２の通電パターンで第１および第２のヒータへの通電を行うことを交互に繰り返す。

【００２４】別の方法として、上記の第１および第２のヒータへの第１の通電パターンと、第１および第２のヒータの一方のみへの間引き数０の通電とを交互に切り替える方法も考えられる。

【００２５】本発明による画像形成装置は、トナー像を用紙上に定着させる定着器を有する画像形成装置であって、前記定着器の定着ヒータとしての第１および第２のヒータと、該第１および第２のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第１および第２のスイッチング手段と、該第１および第２のスイッチング手段のスイッチングを制御する第１および第２のスイッチング手段と、前記定着ヒータのヒータ温度を検出する温度検出手段と、交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第１および第２のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第１および第２のスイッチング手段を制御する制御手段とを備えたことを特徴とする。

【００２６】この画像形成装置において、好ましくは、前記第１のヒータと第２のヒータとは、発熱強度の分布を異にする。

【００２７】

【発明の実施の形態】以下、本発明の好適な実施の形態について、詳細に説明する。

【００２８】本発明が適用される定着器の概略構成については、図１および図２を参照して上述したとおりである。すなわち、定着ヒータとしてのメインヒータ４とサブヒータ５の２本のヒータを原則として交互に点灯させ、各ヒータの点灯時間を調節することで、ヒータローラ表面上での温度分布を均一化させる。

【００２９】図３に示した両ヒータへの通電パターンは本発明によるものではないが、この通電パターンを用いて、２本のヒータを利用することの意義を簡単に説明する。

【００３０】通紙のないスタンバイ時には、図３に示した様にサブヒータ５に比較してメインヒータ４の通電は短く、両ヒータが交互点灯される。また、通紙時であって、小さなサイズの用紙の場合はヒータローラの中央付近の潜熱が奪われるから、メインヒータ４の点灯時間を長くする。このようにして、スタンバイ時、コピー時などのモード毎に交互点灯時間を切り替えてヒータローラ上の熱分布を均一にする様にし、特に小サイズ紙通紙の場合では、ヒータローラ上の非通紙部分、即ち（両サイドに近い部分）の不必要な昇温を防止し、ヒータローラ端部の軸受けや駆動ギア部分の過昇温による損傷を防止する。

【００３１】本実施の形態では、平均電流の急激な変動を抑止しつつ、このような２本のヒータの発熱制御と等価な結果を得ようとするものである。

【００３２】図６に、本発明による「波数制御」の一例を示す。これは、ハロゲンヒータの突入電流部に対して実施される。突入電流部は、ヒータＯＮ直後の立ち上がり部であり、平均的に、徐々に電流が増加するようにすればよい。そのために、この例では、メインヒータＯＮから開始して、まず期間ａに示した様に３半周期に１回の半波長分を周期的に通電する（これを「１／３半波」と呼ぶ）。次に、期間ｂに示したように、３半周期に２回の半波長分を周期的に通電する（これを「２／３半波」と呼ぶ）。続いて、メインヒータを必要な時間だけ全周期分通電してもよい（これを「全周期」と呼ぶ。図示せず）。この後、メインヒータ４を消灯し、サブヒータ５のみの通電を続けるが、同様に、まず、１／３半波の期間ｃ、次に、２／３半波の期間ｄ、その後、間引きなしの全周期の期間ｅとなる。

【００３３】即ち、これは、立ち上がり時に平均電流を、段階的（ここでは３段階）に小さい方から順次大きくなる方向へ切り替えて行き、最後に全周期へ移行するようにするということである。言い換えれば、立ち上げの最初は最も突入電流が多いため、３半波長周期のうち２半波長分間引き（期間ａまたは期間ｃ）、その後ヒータ線が少し暖まった所で、突入電流も減少してくるため、３半波長周期のうち１半波長分間引く（期間ｂまたは期間ｄ）。そして最後に、間引き数０の全周期印加に切り替えると言うことになる。

【００３４】ここで、３半波長周期を基準に波数間引きを行うことが好ましい理由を説明する。例えば２半波長（通常の１周期のこと）を基準としてみれば、これから、１半波長分間引くと半波整流波形と同じ直流成分となってしまう。これでは直流点灯となり、ハロゲンヒータではこのような駆動は推奨されていない。また、３半波長周期より長い周期での間引きは、照明等のチラツキと言う性格上、その間引き操作自体、人の目にチラツキとして感じ易くなってくる。従って、２半波長以外の一番短い周期、即ち３半波長周期で考えるのが一番妥当と言うことになる。事実、この３半波長周期の間引きに於

いて、実際に照明を接続しチラツキを観測した場合、実験的にもチラツキ感は殆ど感じられなかった。

【００３５】しかしながら、３半波長周期より長い周期での間引きでも従来よりは効果が認められるので、後述するように、本発明は、これを排除するものではない。

【００３６】次に、２つのハロゲンヒータ切り替え時、すなわち、メインヒータ４とサブヒータ５の一方から他方への切り替え時に生じる電流変化（図３内のＰ３，Ｐ４部）の軽減方法について述べる。

【００３７】従来、２本ヒータの周期的な切り替えは、図３に示した様に、一方の次に他の一方と言うように比較的大きな周期（数百ｍＳｅｃ～数Ｓｅｃ程度）で行っていた。本発明では、この切り替えを極限にまで早くするという考え方で行う。

【００３８】図７に、本実施の形態における切り替え方法を示す。まず、状態Ｍ１に示すように、メインヒータ４を半波長通電し、それに続く２半波長は状態Ｓ２に示すようにサブヒータ５のみ通電するという制御を繰り返す。このようにした合成電流は、状態Ｍ１＋Ｓ２に示すとおり、２つのヒータ切り替えによる電流変動は３半波長周期毎に細かく分解された形となる。３半波長周期の変動による電源電圧変動は、微小時間間隔で生じるため、事実上、照明などのチラツキとして感知されない。実際、このような考え方を適応すれば、２本のヒータの切り替えを、従来は、図８に示した様にメインヒータ４にNm個の連続的な半波（Ｍ３）印加後、サブヒータ５がNs個の連続的な半波（Ｓ３）印加の繰り返しで行っていたとすれば、これと等価の３半波長周期毎のヒータ切り替えは、図９に示した様にメインヒータ４の３半波長内の１半波長通電（図７内Ｍ１状態）と、サブヒータの３半波長内の２半波長分通電（図７内Ｓ２状態）とを合成するパターン、即ち、図７のＭ１＋Ｓ２状態に示した通電パターンとなる。この通電パターンは、２Ns－Nm個の半波長分（図９内Ａ部）継続する。

【００３９】次に、メインヒータ４の２半波長通電（図７内Ｍ２状態）と、サブヒータ５の１半波長通電（図７内Ｓ１状態）とを合成するパターン、即ち、図７のＭ２＋Ｓ１状態に示した通電パターンで、２Nm－Ns個の半波長分印加（図９内Ｂ部）を行う。このような、図９内Ａ，Ｂ部の繰り返しが、従来の切り替えパターン（図８）と等価である。その理由は、（１）図９内Ａ，Ｂを１周期と見たときの繰り返し周期は、Nm＋Ns個の半波長分で、従来パターン（図８）の場合と同じであること。

【００４０】（２）図９内Ａ，Ｂ部内のメインヒータ４の全印加半波の数はNm、サブヒータ５のそれはNsで、従来パターンの１周期内の通電半波数と同じである。

【００４１】（３）（１），（２）より、従来パターンの印加と比較して、各々のヒータの発熱量は、周期毎で見れば明らかに等しい。

【００４２】更に、考えを進めて、図９内Ａ，Ｂ内部の３半波長周期内の変動は問題にならないことは既に述べたが、同図内Ａ部とＢ部との平均電流差は問題にはなる。しかし、この量を評価してみると、Ａ部内の平均電流は、（１／３）Ｉm+（２／３）Ｉsとなり、また、Ｂ部内の平均電流は、（２／３）Ｉm+（１／３）Ｉsとなる。従って、両者Ａ，Ｂ部分の差は、

（（１／３）Ｉm+（２／３）Ｉs）－（（２／３）Ｉm+（１／３）Ｉs）＝（１／３）（Ｉs－Ｉm）

となり、従来の場合の１／３になっていることが分かる。（ここに、Ｉmは、メインヒータ４へ全周期印加したときの定常電流値、Ｉsは、サブヒータへのそれとする。）上記の特別な場合で、２Nm≦Nsであるときを考えてみる。この場合、図９のＢ部の半波数が負になる。そこで、図１０に示すように３Nm半波長分サブヒータ５をＳ２状態印加にし、メインヒータ４はＭ１状態印加にした波形を加え、その後、サブヒータ５のみのＳ３状態を（Ns－２Nm）半波分印加する。この場合を考えてみても、繰り返し周期は、Ｔ＝Nm＋Ns（半波の個数）であるし、その周期Ｔ内のメインヒータ４に印加される半波数はNm、サブヒータに印加されるそれはNsで、従来の切り替えのときと変わらない。更に、図１０内Ａ’，Ｂ’部間の平均電流差は、

（（１／３）Ｉm+（２／３）Ｉs）－Ｉs＝（１／３）（Ｉm－Ｉs）

となって、従来の場合（図８）の１／３になっていることが分かる。

【００４３】２Ns≦Nmの場合も同様に考えれば良い。すなわち、図示しないが、図１０内のＡ’部をＳ１＋Ｍ２状態、Ｂ’部をＭ３状態と考える。また、このときのＡ’部の半波数を３Nsとし、Ｂ’部の半波数をNm－２Nsとする。この場合のＡ’，Ｂ’部間の平均電流の差は、

（（１／３）Ｉs+（２／３）Ｉm）－Ｉm＝　－（１／３）（Ｉm－Ｉs）

となり、符号は反転するが、やはり、電流差の絶対値は従来の場合の１／３になっていることが分かる。

【００４４】要するに本実施の形態では、３半波長の周期内において、ヒータ立ち上げ時は波形を間引くことによりその平均電流が低い状態より立ち上げると言うことと、ヒータ切り替え時は、３半波の周期内でメインヒータ４とサブヒータ５とを、１半波とそれに続く２半波（１周期）の割合でスイッチングすれば、両ヒータ間の電流差によって引き起こされる電源変動周波数が高くなり、結果として、その電源に接続された照明等のチラツキが人の目には、感じなくなることを利用しているといえる。

【００４５】図１１は、上述した「波数制御」を実現するための回路図である。

【００４６】この図中、ＴＨは、ヒータローラ（図１内

１）の温度を検知するサーミスタ等の温度センサ（図１内６）であり、これは抵抗Ｒ１に接続され、その分圧電位は、ＣＰＵ内のアナログ入力端子Ａ／Ｄに入力されている。Ａ／Ｄ端子に与えられた信号は、アナログ／デジタル変換され、ＣＰＵ内で処理される。ＣＰＵのＩＮＴ入力端子には、交流電源電圧のゼロクロス点に対応するゼロクロスパルス（図１３参照）が入力されている。このゼロクロスパルスは、電源の交流電圧入力に基づいて、フォトカプラＰＣ１および比較器ＣＯＭにより生成される。

【００４７】ゼロクロスパルスの立ち下がりに応じてＣＰＵ内部の割り込みルーチン（後述）が起動され、このゼロクロス信号立ち下がり直後に、所定のタイミングで、それぞれメインヒータ４，サブヒータ５を点灯させる信号ＯＵＴ１，ＯＵＴ２が出力される。

【００４８】例えば、ＯＵＴ１出力がＨレベルのときには、トランジスタＴＲ１がＯＦＦとなり、ホトトライアックＰＴ１の発光側は消灯している。ＰＴ１の受光側ホトトライアックもＯＦＦであるのでトライアックＴ１のゲート電流は流れないから、トライアックＴ１はＯＦＦ状態となり、メインヒータ４は消灯となる。なお、本実施の形態において、トランジスタＴＲ１とホトトライアックＰＴ１とトライアックＴ１とは「スイッチング手段」を構成する。

【００４９】反対に、ＯＵＴ１がＬレベルのときは、上述と逆の動作をし、トランジスタＴＲ１はＯＮ、ホトトライアックＰＴ１の発光ダイオードは点灯し、受光側ホトトライアックはＯＮする。トライアックＴ１のゲートへは、ＰＴ１の受光側が導通するから、抵抗Ｒ２またはＲ４によって限流されたゲート電流が供給される。従って、トライアックＴ１は導通となって、メインヒータ４は点灯する。

【００５０】トライアックＴ１に並列に接続された抵抗Ｒ６とコンデンサＣ１の接続は、いわゆるスナバ回路であり、外来ノイズなどの影響によって電源電圧の急激な変化があったとき、トライアックＴ１が自立的にＯＮするのを防止するためのものである（抵抗Ｒ７とコンデンサＣ２についても同様）。

【００５１】サブヒータ５の点灯を制御するＯＵＴ２出力の流れも、上記と同じである。

【００５２】以上、説明した回路によって行われる制御の実例を説明する。ここでは、メインヒータ４とサブヒータ５の切り替え時の２つの通電パターンを図１０の状態Ａ’，Ｂ’に対応するものとしたが、適用する対象等に応じて、図９に示したような別の通電パターンの組合せとすることができる。

【００５３】図１２に示した様に、図１１内のＣＰＵＡ／Ｄ入力値、即ち、ヒータローラ１の温度に対応した信号が、目標温度より上回っているとき（ローラ温度が高いとき）には、メインヒータ４およびサブヒータ５は、共にＯＦＦである。また、下回ったときには、図１２に示した様に、状態ａ→ｂ→ｃ→ｄ→ｅからｆ→ｅ→ｆ→ｅを繰り返す形で、ローラ温度が目標温度値を上回るまでヒータ点灯制御する。この内の状態ａとは、前述した様に、図７に示すメインヒータ４のＭ１通電（３半波長中１半波長ＯＮ）状態で、サブヒータ５はＯＦＦである。状態ｂは、メインヒータ４がＭ２通電（図７内のＳ２波形）、サブヒータ５がＯＦＦである。状態ｃは、メインヒータＯＦＦ、サブヒータ５はＳ１である。状態ｄは、メインヒータ４はＯＦＦ、サブヒータ５はＳ２である。

【００５４】この様に、状態ａ，ｂ，ｃ，ｄで突入電流に対する各ヒータの電流変化を緩和させる。これについては、図６に示した内容と同じであるので、既に説明したとおりである。それ以降の状態ｅ，ｆの繰り返しについて言えば、状態ｅは、メインヒータ４はＯＦＦで、サブヒータ５は全周期ＯＮ（Ｓ３）である。状態ｆは，メインヒータ４がＭ１通電でサブヒータ５がＳ２の合成通電である。このパターンは、図７に示したパターンと同一であって、これについても既に説明したとおりである。要するに、これは、メインヒータ４とサブヒータ５の切り替え時に生ずる切り替え電流変化を低減するための操作である。

【００５５】図１４に、上述の制御を実現するためのソフトウエア手順の一例を表すフローチャートを示す。

【００５６】ＣＰＵ（図１１）に対する割り込み入力ＩＮＴに対しては、図１３に示したゼロクロスパルスが与えられているのは既に述べた。このゼロクロスパルスの立ち下がりによって、ＣＰＵ内処理に割り込み動作が掛かり、図１４のフローに示した手順が実行される。

【００５７】まず、Ａ／Ｄ入力値が、目標温度より高い場合は、判断Ｓ１４１により処理はＮ側に流れて、カウンタａ，ｂ，ｃ，ｄ，ｅ，ｆにそれぞれの初期値０がセットされる（Ｓ１４２）。また、ＯＵＴ１，ＯＵＴ２に各々１がセットされ（Ｓ１４３）、これによってメインヒータ４およびサブヒータ５は共にＯＦＦされる。カウンタａ，ｂ，ｃ，ｄ，ｅ，ｆは、図１２に示したヒータＯＮ時の状態ａ，ｂ，ｃ，ｄ，ｅ，ｆの各々の継続時間を決めるカウンタで、それらはゼロクロスパルスの数、つまり、電源半波の数で管理される。

【００５８】以上、ローラ温度が目標より高いときの処理を述べたが、Ａ／Ｄ入力値が目標温度より下回った（温度が低い）値を示したならば、割り込みが掛かる毎にフロー内Ｓ１４１で判断し、今度は、そのＹ側に処理が流れる。その時点で、間引きカウンタＴＯに、１が加算される（Ｓ１４４）。この間引きカウンタＴＯは、０→１→２→０→１→２と、割り込みによりフローのこの部分を通過する都度、状態が一つ進み三つの状態の巡回を続ける。判断Ｓ１４５で、カウンタ値が３になったとき、初期値０に戻す様にしている（Ｓ１４６）。このカ

ウンタＴＯは、以降の処理中で、３半波長中のどの位置の半波長を指すのかの指示ポインタの役目を果たす。

【００５９】判断Ｓ１４７で、ａカウンタの状態を見て、予め定めた規定値Ａに達していなければ、即ち、図１２内のａ状態であればＮ側へ処理が流れ、ａカウンタを１カウントアップさせる（Ｓ１３８）。ここに、規定値Ａは状態ａにおける半波の個数である（後述する他の規定値についても同様）。次に判断Ｓ１４９で、前述の間引きカウンタＴＯの値を確認する。この値が０であれば、メインヒータ４をＯＮし（Ｓ１５０）、それ以外の値１または２であれば、メインヒータ４、サブヒータ５共にＯＦＦ状態とする（Ｓ１５１）。

【００６０】ヒータ温度が目標温度より低いときであって、ＩＮＴ入力にゼロクロスパルスの立ち下がりが入る都度に、間引きカウンタＴＯが巡回（０→１→２→０→・・・）され、かつａカウンタがその規定値Ａに達していなければ、判断部Ｓ１４９をその都度通過し、メインヒータ４を３半波に１半波分のみ周期的にＯＮすることになる。判断部Ｓ１４９では、図７内に示した通電状態Ｍ１を作り出していると言える。ａカウンタが規定値Ａに達すれば、図１２に示した状態ａを終了して、状態ｂに移行する。すなわち、フロー内Ｓ１５２でｂカウンタの状態を確認し、その規定値Ｂに達していなければ、Ｎ側に処理が流れｂカウンタを１カウントアップし（Ｓ１５３）、判断Ｓ１５４で間引きカウンタＴＯの値が、０または１のときにのみメインヒータ４をＯＮする（Ｓ１５５，Ｓ１５６）。これは、図７に示した通電状態Ｍ２を実現していると言える。

【００６１】以上、同様に判断部Ｓ１５７では図１２内のｃ状態であるかどうかを見て、そうであれば判断Ｓ１５８でｃカウンタを１カウントアップし、間引きカウンタＴＯを見て（Ｓ１５９）、間引きカウンタＴＯが０のときサブヒータ５のみＯＮしＳ１状態（図７内）を実現する（Ｓ１６０，Ｓ１６１）。そして、次の判断Ｓ１６２ではｄ状態を判断し、ｄカウンタの１カウントアップ（Ｓ１６３）の後、判断Ｓ１６４でサブヒータ５のみをＳ２状態とする（Ｓ１６５，Ｓ１６６）。更に、次の判断Ｓ１６７ではｅ状態を判断し、ｅカウンタの１カウントアップ（Ｓ１６８）の後、サブヒータ５のみをＳ３状態とする（Ｓ１６９）。

【００６２】以上で、図１２内のａ，ｂ，ｃ，ｄ，ｅ状態を完了する。すなわち、図６に示した一連の立ち上がり部シーケンスを終結したことになる。

【００６３】次の判断Ｓ１７０では、図１２内のｆ状態であるか否かを判断する。ｆカウンタがその規定値Ｆに達しない間、処理はＮ側に流れ、ｆカウンタを１カウントアップし（Ｓ１７１）、判断Ｓ１７２で間引きカウンタＴＯを確認して、その値が０であればメインヒータ４のみをＯＮし（Ｓ１７４）、それ以外は、サブヒータ５のみをＯＮする（Ｓ１７３）。結果としてメインヒータＭ１状態と、サブヒータＳ２状態が合成された形のＭ１＋Ｓ２（図７内参照）の通電状態となる。

【００６４】また、このｆカウンタが規定値Ｆに達したときは、判断Ｓ１７０で処理がＹ側に流れｅカウンタおよびｆカウンタに初期値０が再セットされる。その結果、次のＩＮＴ割り込みでは、判断Ｓ１６７のｅカウンタの規定値到達が解除されてることになるので、もう一度ｅ状態、即ち、サブヒータ５がＯＮ（Ｓ３状態）となって、ｆ→ｅ→ｆ→・・・と、この２状態が繰り返されることとなる。

【００６５】この様にして、図１２内に示したヒータの点灯状態が実現できることが示された。

【００６６】なお、ａ～ｆカウンタは、上記と異なり、それらの規定値Ａ，Ｂ，Ｃ，Ｄ，Ｅ，Ｆを初期値として設定した後、減数していくことにより、各カウンタ値が０に達したか否かを調べるようにしてもよい。

【００６７】以上の実施の形態によれば、次のような格別な効果が得られる。

【００６８】（１）制御ハードウェアが比較的単純となる。例えば、ヒータ電流を抑制する手段としては、前述した様に一般的に位相制御方式が挙げられるが、この場合、電源電圧のゼロクロス点からタイマを設定してヒータをＯＮすべき位相角（半波長の時間より充分短い時間間隔での時間）を指定するパルスを発生させる必要がある。これらは制御自体の複雑性とタイマ機構等のハードウエアを用意しなければならないという欠点を有する。本発明のような「波数制御」であれば、ゼロクロス起点でヒータをＯＮするのみであるため、位相を決定するタイマが不要となる。また、その分それらの設定、起動等、制御上の複雑性は減少する。

【００６９】（２）位相制御と比較したときの他の利点は、「波数制御」の場合、ヒータ電流がゼロクロス起点から印加されるため、電源ライン上における電源周波数の高次の周波数の電流変化、いわゆる電源高調波の発生が殆どないということである。通常、このような電源高調波の発生を押さえるために、ヒータと直列に大容量のインダクタンス（チョークコイル）を挿入したりすることが必要となるが、これは余計な電気部品の追加によるコスト上昇を招来し、またその設置場所の確保の要請が機械のコンパクト化を妨げる原因になっていた。

【００７０】以上では、本発明の「波数制御」に関する典型例を示したが、以下の形の変形も考えられる。

【００７１】図６には突入電流を緩和するための例を示した。例えば、この中の状態ｂやｄがなく、１／３半波のみから全周期波形への移行であっても、やはり電流変動の大きさを減らすと言う意味で一定の効果を有する。同様に、状態ａまたはｃが無く、状態ｂまたはｄのみの場合も同じことが言える。

【００７２】要するに、この立ち上げ時に３半波長単位の周期の中から、１または２半波長分間引くことで平均

電流値を減らして突入電流の大きさを減らすことのできる全ての組み合わせについてを本発明は含んでいる。

【００７３】図９には、メインヒータ４とサブヒータ５の交互点灯、いわゆるフリッカリング点灯の場合の例を示したが、これについても同様に、３半波長単位の周期の中から１または２半波長間引いた波形を用いた形のもので、サブヒータ５およびメインヒータ４において可能なもののあらゆる組合せの中で、従来の全周期印加による切り替え電流差を減少させるものであれば本発明の範囲内である。

【００７４】例えば、以上の説明では、主として３半波長を基準とする場合について説明したが、図１５に示すように、４半波長周期、５半波長周期、７半波長周期、１１半波長周期等の各々について、図６及び図７のような波数制御も可能である。

【００７５】さらには、単一のヒータのみを用いる場合にも、図６に示したような波数を次第に増加させていく制御は有効である。

【００７６】

【発明の効果】本発明によれば、位相制御によらず、ハロゲンヒータによる急激な電流変化を低減することができるので、制御ハードウェアを比較的単純化することができる。また、ヒータ電流がゼロクロス起点から印加されるため、電源ライン上における電源高調波の発生を殆どなくすことができる。

【００７７】

【図面の簡単な説明】

【図１】本発明が適用される定着器の概略図である。

【図２】図１の定着器のメインヒータとサブヒータの発熱強度分布を示すグラフである。

【図３】図１の定着器のメインヒータとサブヒータの通＊電状態の一例を示すタイミング図である。

【図４】位相制御によるヒータへの通電を説明するためのタイミング図である。

【図５】機器の電流電動に伴って生じる電圧変動を説明するための回路図である。

【図６】本発明の実施の形態におけるヒータ立ち上げ時の波数制御の一例を示す電流波形図である。

【図７】本発明の実施の形態におけるメインヒータとサブヒータの切り替え時に用いる通電パターンを示す電流波形図である。

【図８】メインヒータとサブヒータの従来の切り替え方を示す説明図である。

【図９】図８と等価な本発明の実施の形態におけるメインヒータとサブヒータの通電状態を示す説明図である。

【図１０】図９のメインヒータとサブヒータの通電状態の変形例を示す説明図である。

【図１１】本発明の実施の形態におけるメインヒータとサブヒータの通電状態を実現するための回路を示す回路図である。

【図１２】図１１の回路によって行われる制御の実例の説明図である。

【図１３】図１１の回路で検出される電源電圧のゼロクロスパルスの説明図である。

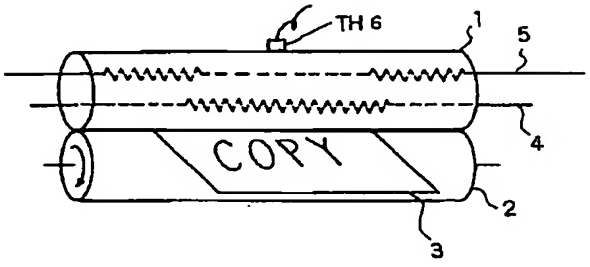
【図１４】図１１のＣＰＵによって実行される割り込み処理の一例を示すフローチャートである。

【図１５】本発明の実施の形態の変形例を示す波形図である。

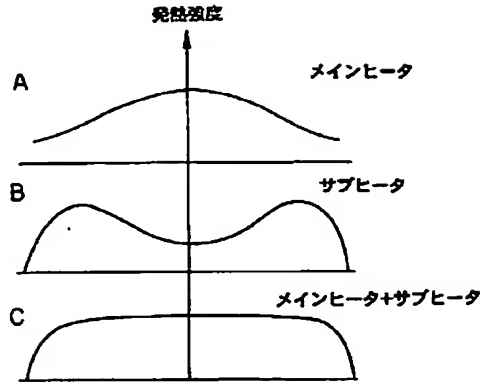
【符号の説明】

１…ヒータローラ、２…加圧ローラ、３…用紙、４…メインヒータ、５…サブヒータ、６…温度センサ。

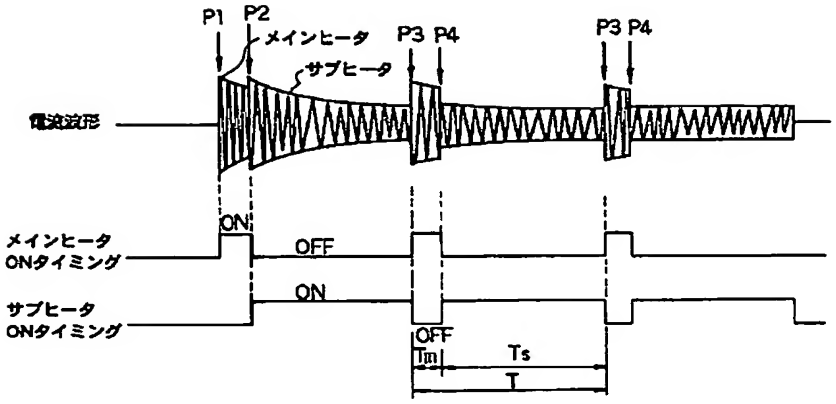
【図１】



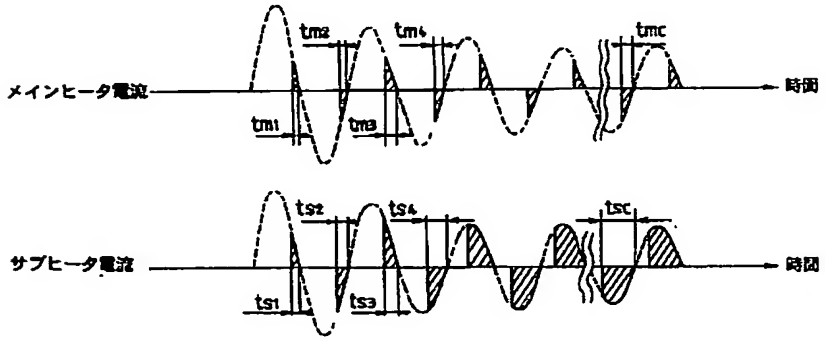
【図２】



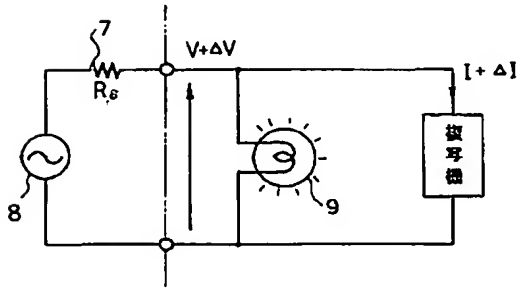
【図３】


P1
P2
メインヒータ
P3 P4
サブヒータ
P3 P4
電流波形
ON
メインヒータ
ONタイミング
OFF
ON
サブヒータ
ONタイミング
OFF
Tm
Ts
T

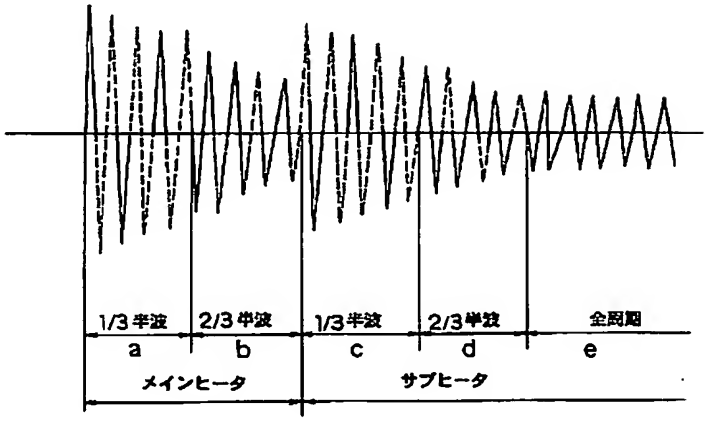
【図４】


tm2
tm4
tmc
メインヒータ電流
時間
tm1
tm3
ts2
ts4
tsc
サブヒータ電流
時間
ts1
ts3

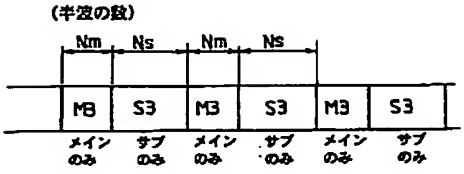
【図５】


7
V+ΔV
[+Δ]
R6
8
9
複写機

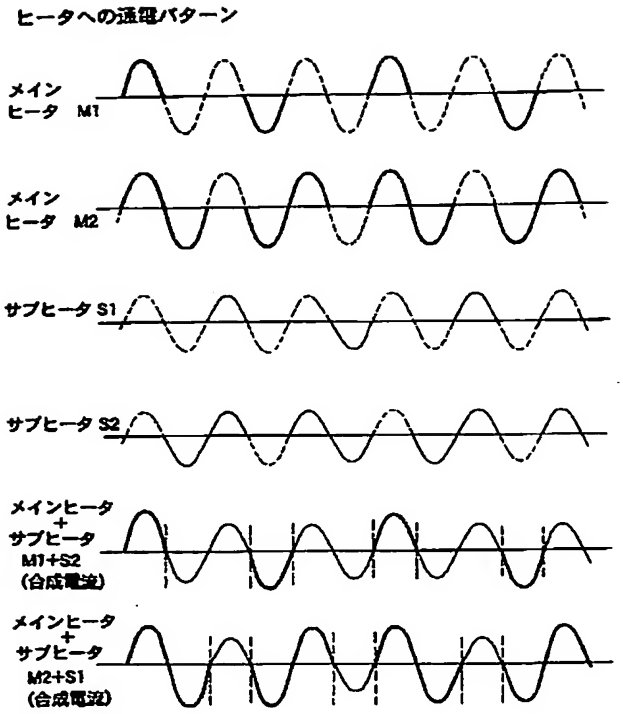
【図６】


1/3半波
2/3半波
1/3半波
2/3半波
全周期
a
b
c
d
e
メインヒータ
サブヒータ

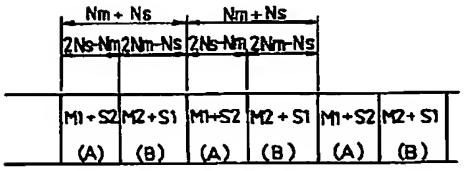
【図８】


(半波の数)
Nm
Ns
Nm
Ns
M3
S3
M3
S3
M3
S3
メイン
のみ
サブ
のみ
メイン
のみ
サブ
のみ
メイン
のみ
サブ
のみ

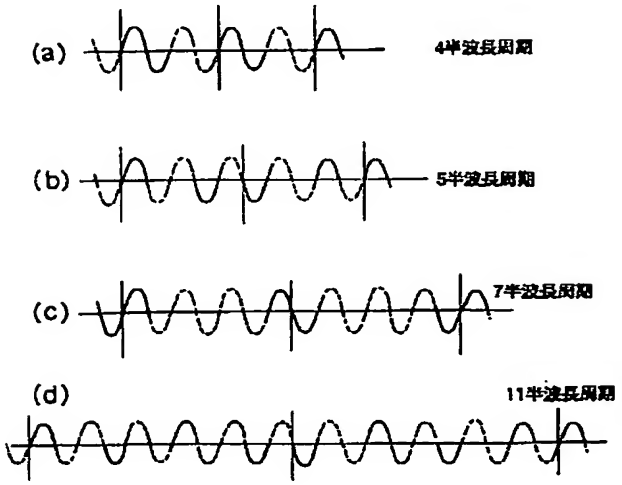
【図７】



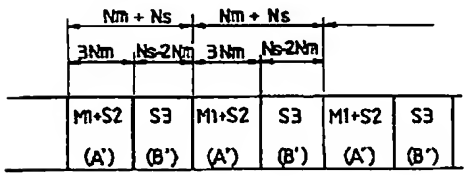
【図９】



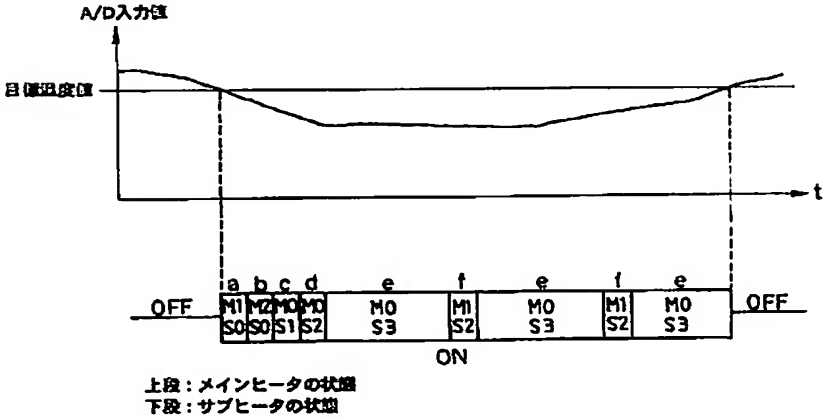
【図１５】



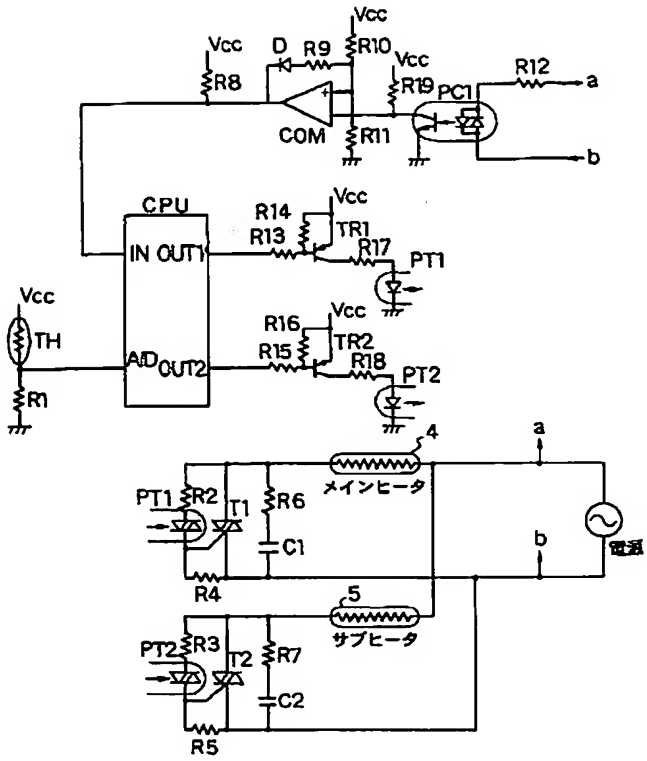
【図１０】



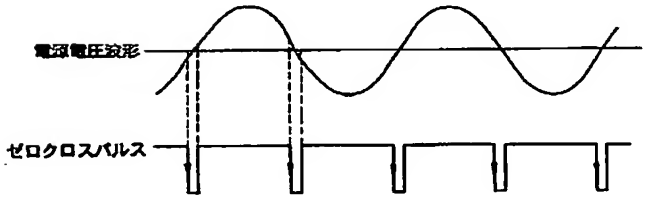
【図１２】



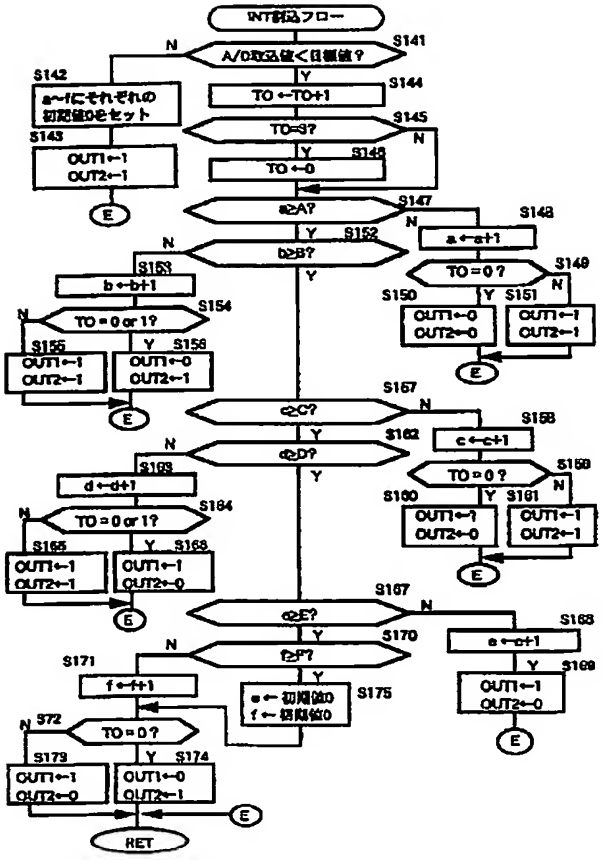
【図１１】


Vcc
D
R9
R10
R8
R19
PC1
R12
a
COM
R11
b
CPU
IN
OUT1
R14
R13
TR1
R17
PT1
TH
R16
R15
TR2
R18
PT2
A/D
OUT2
R1
4
メインヒータ
PT1
R2
T1
R6
C1
R4
5
サブヒータ
PT2
R3
T2
R7
C2
R5
電源

【図１３】


電源電圧波形
ゼロクロスパルス

【図１４】

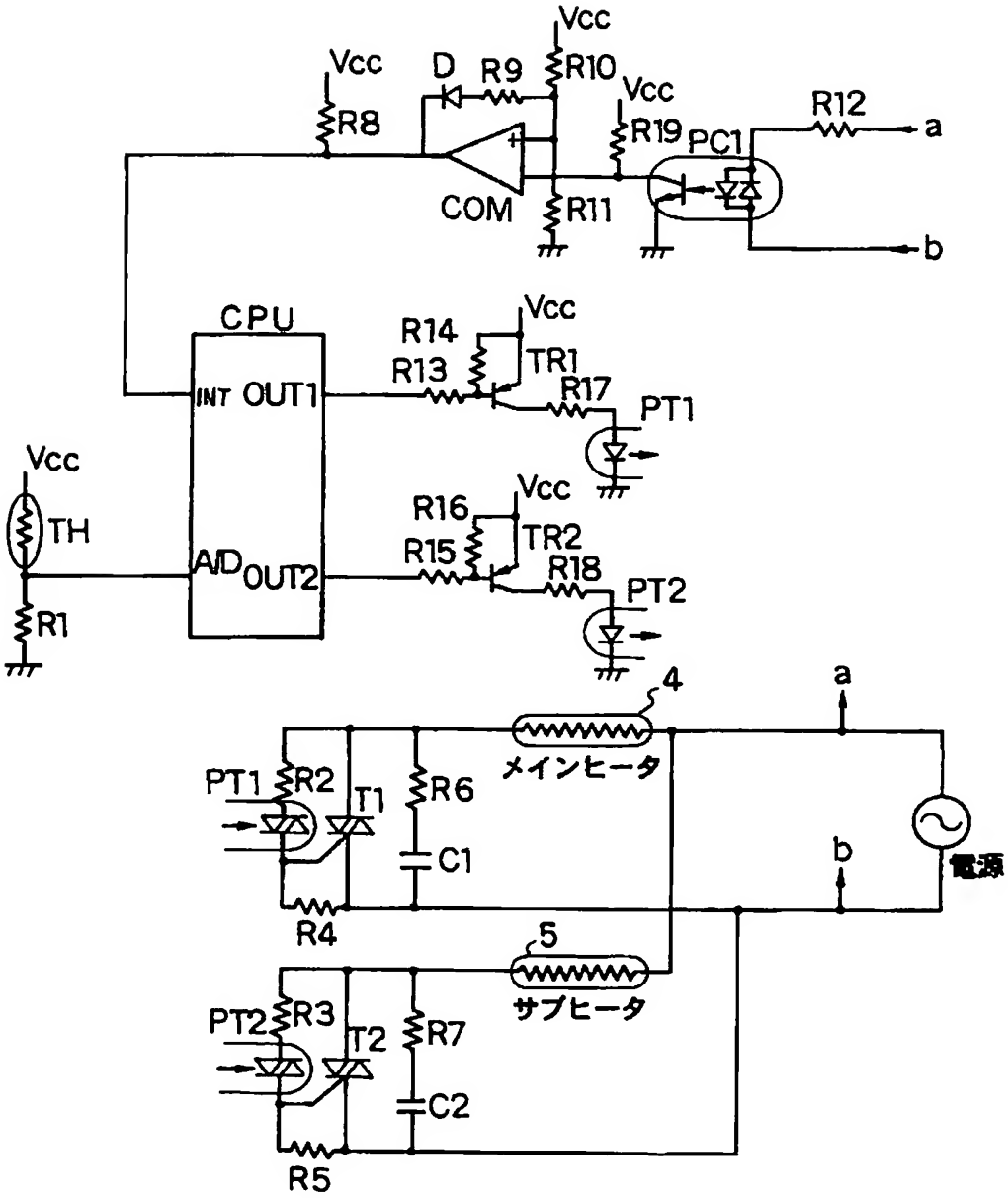

INT割込フロー
A/D変換値＜目標値？
S141
S142
a～fにそれぞれの初期値0をセット
S143
OUT1←1
OUT2←1
TO←TO+1
S144
TO=3？
S145
S146
TO←0
a≧A？
S147
S148
a←a+1
b≧B？
S152
S153
b←b+1
TO＝0？
S149
S150
S151
TO＝0 or 1？
S154
S155
S156
c≧C？
S157
S158
c←c+1
d≧D？
S162
S163
d←d+1
TO＝0？
S159
S160
S161
TO＝0 or 1？
S164
S165
S166
e≧E？
S167
S168
e←e+1
f≧F？
S170
S171
f←f+1
S175
TO＝0？
S172
S173
S174
RET

【公報種別】特許法第１７条の２の規定による補正の掲載
【部門区分】第６部門第２区分
【発行日】平成１３年１０月５日（２００１．１０．５）

【公開番号】特開平１１－９５６１１
【公開日】平成１１年４月９日（１９９９．４．９）
【年通号数】公開特許公報１１－９５７
【出願番号】特願平９－２７２１０７
【国際特許分類第７版】
G03G 15/20 109
G05F 1/455
【Ｆ１】
G03G 15/20 109
G05F 1/455 B

【手続補正書】
【提出日】平成１２年１２月２１日（２０００．１２．２１）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】請求項９
【補正方法】変更
【補正内容】
【請求項９】トナー像を用紙上に定着させる定着器を有する画像形成装置であって、
前記定着器の定着ヒータとしての第１および第２のヒータと、
該第１および第２のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第１および第２のスイッチング手段と、
前記定着ヒータのヒータ温度を検出する温度検出手段と、
交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、
前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第１および第２のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第１および第２のスイッチング手段を制御する制御手段と
を備えたことを特徴とする画像形成装置。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００２５
【補正方法】変更
【補正内容】
【００２５】本発明による画像形成装置は、トナー像を用紙上に定着させる定着器を有する画像形成装置であって、前記定着器の定着ヒータとしての第１および第２のヒータと、該第１および第２のヒータに対する交流電源電圧の印加をそれぞれ独立に制御する第１および第２のスイッチング手段と、前記定着ヒータのヒータ温度を検出する温度検出手段と、交流電源電圧のゼロクロス点を検出するゼロクロス検出手段と、前記温度検出手段により検出された温度が予め定められた温度より低下したとき、前記ゼロクロス検出手段によるゼロクロスの度に、順次、予め定められた手順で前記第１および第２のヒータに対して半波長単位の前記電源電圧の印加の是非を決定し、該決定結果に基づいて前記第１および第２のスイッチング手段を制御する制御手段とを備えたことを特徴とする。
【手続補正３】
【補正対象書類名】明細書
【補正対象項目名】００３２
【補正方法】変更
【補正内容】
【００３２】図６に、本発明による「波数制御」の一例を示す。これは、ハロゲンヒータの突入電流部に対して実施される。突入電流部は、ヒータＯＮ直後の立ち上がり部であり、平均的に、徐々に電流が増加するようにすればよい。そのために、この例では、メインヒータＯＮから開始して、まず期間ａに示した様に３半周期に１回の半波長分を周期的に通電する（これを「１／３半波」と呼ぶ）。次に、期間ｂに示したように、３半周期に２回の半波長分を周期的に通電する（これを「２／３半波」と呼ぶ）。続いて、メインヒータを必要な時間だけ全周期分通電してもよい（これを「全周期」と呼ぶ。図示せず）。この後、メインヒータ４を消灯し、サブヒータ５のみの通電を続けるが、同様に、まず、１／３半波の期間ｃ、次に、２／３半波の期間ｄ、その後、間引きなしの全周期の期間ｅとなる。
【手続補正４】
【補正対象書類名】明細書

【補正対象項目名】００５９
【補正方法】変更
【補正内容】
【００５９】判断Ｓ１４７で、ａカウンタの状態を見て、予め定めた規定値Ａに達していなければ、即ち、図１２内のａ状態であればＮ側へ処理が流れ、ａカウンタを１カウントアップさせる（Ｓ１４８）。ここに、規定値Ａは状態ａにおける半波の個数である（後述する他の規定値についても同様）。次に判断Ｓ１４９で、前述の間引きカウンタＴＯの値を確認する。この値が０であれば、メインヒータ４をＯＮし（Ｓ１５０）、それ以外の値１または２であれば、メインヒータ４、サブヒータ５共にＯＦＦ状態とする（Ｓ１５１）。
【手続補正５】
【補正対象書類名】明細書
【補正対象項目名】００６３
【補正方法】変更
【補正内容】
【００６３】次の判断Ｓ１７０では、図１２内のｆ状態であるか否かを判断する。ｆカウンタがその規定値Ｆに達しない間、処理はＮ側に流れ、ｆカウンタを１カウントアップし（Ｓ１７１）、判断Ｓ１７２で間引きカウンタＴＯを確認して、その値が０であればメインヒータ４のみをＯＮし（Ｓ１７４）、それ以外は、サブヒータ５のみをＯＮする（Ｓ１７３）。結果としてメインヒータＭ１状態と、サブヒータＳ２状態が合成された形のＭ１＋Ｓ２（図７内参照）の通電状態となる。
【手続補正６】
【補正対象書類名】明細書
【補正対象項目名】００６４
【補正方法】変更
【補正内容】
【００６４】また、このｆカウンタが規定値Ｆに達したときは、判断Ｓ１７０で処理がＹ側に流れｅカウンタおよびｆカウンタに初期値０が再セットされる。その結果、次のＩＮＴ割り込みでは、判断Ｓ１６７のｅカウンタの規定値到達が解除されていることになるので、もう一度ｅ状態、即ち、サブヒータ５がＯＮ（Ｓ３状態）となって、ｆ→ｅ→ｆ→・・・と、この２状態が繰り返されることとなる。
【手続補正７】
【補正対象書類名】図面
【補正対象項目名】図１１
【補正方法】変更
【補正内容】
【図１１】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Vcc
D
R9
R10
R8
Vcc
R19
R12
PC1
a
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R11
b
CPU
R14
Vcc
R13
TR1
INT OUT1
R17
PT1
Vcc
TH
R16
Vcc
R15
TR2
A/D OUT2
R18
PT2
R1
4
a
メインヒータ
PT1
R2
T1
R6
C1
b
電源
R4
5
サブヒータ
PT2
R3
T2
R7
C2
R5

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-095611
(43)Date of publication of application : 09.04.1999

(51)Int.Cl. G03G 15/20
G05F 1/455

(21)Application number : 09-272107
(22)Date of filing : 18.09.1997

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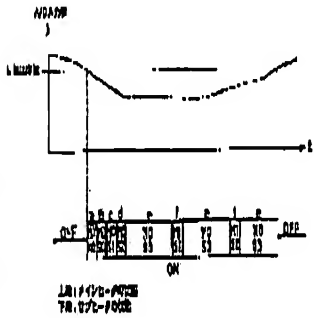
(54) METHOD FOR CONTROLLING FIXING HEATER AND IMAGE FORMING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for controlling a fixing heater and an image forming device adopting the same, capable of reducing a drastic current change caused by the fixing heater, without depending on the phase control.
SOLUTION: Right after the start of applying an AC power source voltage when the heater temp. falls to fellow a target temp., in order to reduce the heater current, by regarding 3 halfwave lengths as a period of the AC power source voltage applied to the fixing heater, the thinning number is decreased from a large number to a small one. When the device is provided with two heaters, the same method is successively applied to each of the heater (states a, b, c and d). Subsequently, application of voltage is performed with the thinning number 0. At this time too, by regarding the successive 3 halfwave lengths as one period, power is applied to a first heater by thinning the waveform of one halfwave length or two halfwave lengths out of 3 halfwave lengths for one period, while the power having the waveform of only halfwave lengths which are used for thinning the first heater is applied to a second heater, which is a state (f) of applying a first energizing pattern. The state (f) and the state (e) of energizing only one of the heaters (or state of reversing the relation between both heaters in the state (f)) are alternately repeated, until the heater temp. reaches the desired temp.



LEGAL STATUS

[Date of request for examination] 21.12.2000
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number] 3316170
[Date of registration] 07.06.2002
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

Searching PAJ http://www19.ipdl.ncipi.go.jp/PA1/result/detail/main...

CLAIMS

[Claim(s)]

[Claim 1] The control approach of the fixing heater characterized by to shift to the wave-like impression without infanticide after adopting the control which thins out 1 of them, or the wave for two or more half-wave lengths and impressing the infanticide wave by said infanticide control to said fixing heater immediately after impression initiation of the AC-power-supply electrical potential difference to said fixing heater by making into a period a part for the 3 half-wave lengths which the AC-power-supply electrical potential difference impressed to a fixing heater follows at least.

[Claim 2] The control approach of the fixing heater which is an approach according to claim 1, performs impression of a term two or more rounds as two infanticide, and shifts to impression with zero infanticide after that by making a part for the 3 half-wave length into a period immediately after impression initiation of said AC-power-supply electrical potential difference.

[Claim 3] The control approach of the fixing heater which is an approach according to claim 1, and is considered as zero infanticide after changing the number of infanticide from size to smallness immediately after impression initiation of said AC-power-supply electrical potential difference.

[Claim 4] The control approach of the fixing heater which it is an approach according to claim 3, and performs impression of a term two or more rounds as two infanticide, subsequently performs impression of a term for the number of infanticide two or more rounds as 1, and shifts to impression with zero infanticide after that by making a part for the 3 half-wave length into a period immediately after impression initiation of said AC-power-supply electrical potential difference.

[Claim 5] It is an approach according to claim 1. Said fixing heater In case it consists of the 1st heater and 2nd heater and energizes by turns to said the 1st heater and 2nd heater, a part for the 3 continuous half-wave lengths is made into a period. The control approach of a fixing heater of thinning out and energizing the wave for the 1 half-wave length of the 3 half-wave lengths of one period, or the 2 half-wave lengths at the 1st heater, and impressing the wave only for the half-wave length thinned out at the 1st heater to the 2nd heater.

[Claim 6] The control approach of the fixing heater which is an approach according to claim 5 and changes by turns the 1st energization pattern to the 1st and 2nd heaters according to claim 5, and the 2nd energization pattern which made reverse relation of the 1st and 2nd heaters.

[Claim 7] Continuation impression of the half-wave length of Nm individual [as opposed to / are an approach according to claim 6 and / the 1st heater], As control equivalent to the control which repeats continuation impression of the half-wave length of Ns individual to the 2nd heater by turns, a part for the half-wave length of 2 Ns-Nm individual and said 1st energization pattern perform energization to the 1st and 2nd heaters. Subsequently It is the control approach of the fixing heater characterized by repeating performing energization to the 1st and 2nd heaters by said 2nd energization pattern by turns by the half-wave length of 2 Nm-Ns individual.

[Claim 8] The control approach of the fixing heater which is an approach according to claim 5 and changes the 1st energization pattern to the 1st and 2nd heaters according to claim 5, and energization with one zero infanticide of the 1st and 2nd heaters by turns.

[Claim 9] It is image formation equipment which has the fixing assembly which fixes a toner image on a form. The 1st and 2nd heaters as a fixing heater of said fixing assembly, The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, this — with 1st and 2nd switching means to control switching of the 1st and 2nd switching means When it falls from the temperature as which the temperature detected by temperature detection means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand, The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. Image formation equipment characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.

[Claim 10] It is image formation equipment characterized by said the 1st heater and 2nd heater differing in distribution of exoergic reinforcement in image formation equipment according to claim 9.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to image formation equipments, such as an electrostatic copying machine and a printer, and relates to the heater control approach of reducing fluctuation of the current which includes the rush current by ON/OFF of the fixing heater especially.
[0002]
[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of fixing heater, and there is generating of the very big rush current at the time of that ON. Especially when temperature of a halogen heater the property top of a halogen heater and own is high, the resistance is large, and resistance becomes small when low. Usually, since a halogen heater is turned on when heater temperature becomes lower than the temperature defined beforehand, the big rush current will flow immediately after lighting.
[0003] A voltage variation explanatory view is shown in drawing 5 . Generally, when a supply power source is seen from a power-receptacle side, the comparatively small source impedance (Rs) 7 exists. For this reason, when the consumed electric current I of the device (here copying machine) connected to the power source changes suddenly a lot, fluctuation of supply voltage V occurs and the amount of [**I then] rapid source effect can estimate the current change with that rapid magnitude as **V=Rsx**I. For example, if the luminaire 9 is connected to this plug socket line, rapid voltage variation will serve as CHIRATSUKI of lighting, and will appear.
[0004]
[Problem(s) to be Solved by the Invention] Here, the technical problem of this invention is explained in relation to the configuration of a concrete fixing assembly.
[0005] Drawing 1 is a schematic diagram of a fixing assembly with which this invention is applied, I in this expresses a heater roller and 2 expresses a pressurization roller. Thermal melting arrival of the toner image can be carried out on a form 3 by passing the form 3 with which the toner image was developed between both this roller 1 and 2. In the heater roller 1, it is equipped in the form where the Maine heater 4 and the subheater 5 were illustrated.
[0006] That is, as shown in drawing 2 , the exoergic intensity distribution of the Maine heater 4 have a peak near a center (drawing 2 A), and, on the other hand, the subheater 5 has a peak in a both-ends side (drawing 2 B). These two heaters are made to turn on by turns, and the temperature distribution on a roller front face are made to equalize by adjusting the lighting time amount of each heater (drawing 2 C).
[0007] Although drawing 3 shows the energization current wave form of HITAHE at the time of standby, P1 is a part with a big current change in this. As mentioned above in drawing 5 , this current change produced the voltage variation of the supply power source itself, and has caused evils, such as CHIRATSUKI, such as lighting connected to the same power source. The social request that the voltage variation by current change of such a device will be reduced in recent years has become strong.
[0008] Although this invention offers the approach for reducing the rapid current change by the halogen heater used for the fixing assembly of image formation equipment, it is specifically easing the following rapid current change parts shown in drawing 3 .
[0009] 1 The rush current section of a halogen heater (P1 in drawing 3 , P2 section)
2 The current variation section when changing a heater by turns by the fixing assembly of 2 heater configurations (P3, P4 in drawing 3)
In order to solve such a trouble, energization of HITAHE by phase control as shown in drawing 4 can be considered. What is necessary is just to expand gradually the resistance welding time in 1 half-wave length to rapid voltage variation prevention like [at the time of rush current generating just behind Heater ON] to tm1, tm2, tm3, --, tmc first in the form shown, for example in the energization wave of Maine heater 4 HE in drawing 4 , since what is necessary is just to enlarge effectual magnitude of an electrical potential difference gradually. It is similarly referred to as ts1, ts2, ts3, —, tsc about the subheater 5. tmc which is equivalent to the steady state energization phase angle of the Maine heater 4 in this, and tsc of the subheater 5 are constant value.
[0010] Since the energization power of the Maine heater 4 in this case is Tm/T and a subheater is the rate of Ts/T when this value is returned and considered to the change wave in drawing 3 , it is possible to adjust tmc and tsc according to this value.

[0011] It is also possible to carry out moderate current change near the fact and an ideal by such configuration. However, the following faults also exist in this approach.

[0012] The complexity on control of that the hardware is complicated and those setup, starting, etc., such as a timer style for deciding 1 and a phase angle (namely, time amount, such as **** tmc and tsc), is also considered to become high similarly.

[0013] To the area (regional difference (50Hz and 60Hz)) where 2 differs from a power line period, another setup must be carried out respectively and the complicatedness on the management to the carving is produced.

[0014] Since energization of HITAHE is turned on in the middle in not a zero cross origin but the half-wave length so that clearly even if it sees 3 and drawing 4 , the evil of generating of a higher-harmonic current is produced. Generating this higher-harmonic current by the high order wave (several times to dozens times) of a power line period, this does active jamming as other device HE connected through the feeder, and a noise, and causes malfunction and failure. Therefore, in the case of phase control, in order to reduce this power-source higher-harmonic-wave current, correspondence of inserting a mass choke coil is needed separately.

[0015] This invention proposes how this is conquerable in view of such a trouble. That is, this invention is not based on phase control, but the image formation equipment which adopted the control approach of a fixing heater and this which can reduce the rapid current change by the fixing heater is offered.

[0016]

[Means for Solving the Problem] After the control approach of the fixing heater by this invention adopts the control which thins out 1 of them, or the wave for two or more half-wave lengths by making into a period a part for the 3 half-wave lengths which the AC-power-supply electrical potential difference impressed to a fixing heater follows at least and impresses the infanticide wave by said infanticide control to said fixing heater immediately after impression initiation of the AC-power-supply electrical potential difference to said fixing heater, it is characterized by to shift to the wave-like impression without infanticide.

[0017] By this, generating of the rush current immediately after impression initiation of the AC-power-supply electrical potential difference to a fixing heater can be prevented. Moreover, since it is not based on phase control but the heater current is impressed from a zero cross origin, while abolishing most generating of the power-source higher harmonic on power-source Rhine, control hardware can be simplified comparatively.

[0018] By making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential difference, impression of a term is performed two or more rounds as two infanticide, and, specifically, it shifts to impression with zero infanticide after that.

[0019] According to other standpoints, after the approach of this invention changes the number of infanticide from size to smallness immediately after impression initiation of said AC-power-supply electrical potential difference, it is considered as zero infanticide.

[0020] For example, by making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential difference, impression of a term is performed two or more rounds as two infanticide, subsequently, impression of a term is performed two or more rounds as 1, and the number of infanticide is shifted to impression with zero infanticide after that.

[0021] When said fixing heater consists of the 1st heater and 2nd heater, in case it energizes by turns to said the 1st heater and 2nd heater, at the 1st heater, the wave for the 1 half-wave length of the 3 half-wave lengths of one period or the 2 half-wave lengths is thinned out and energized by making a part for the 3 continuous half-wave lengths into a period, and the wave only for the half-wave length thinned out at the 1st heater is impressed to the 2nd heater.

[0022] In this case, the 1st energization pattern to such 1st and 2nd heaters and the 2nd energization pattern which made reverse relation of the 1st and 2nd heaters are changed by turns.

[0023] As control specifically equivalent to the control which repeats continuation impression of the half-wave length of Nm individual to the 1st heater, and continuation impression of the half-wave length of Ns individual to the 2nd heater by turns It repeats a part for the half-wave length of 2 Ns-Nm individual and said 1st energization pattern performing energization to the 1st and 2nd heaters, and performing energization to the 1st and 2nd heaters subsequently by the energization pattern of the account 2nd of a half-wave length quota of 2 Nm-Ns individual by turns.

[0024] How to change the 1st energization pattern to the 1st and 2nd above-mentioned heaters and energization with one zero infanticide of the 1st and 2nd heaters by turns as an option is also considered.

[0025] The image formation equipment by this invention is image formation equipment which has the fixing assembly which fixes a toner image on a form. The 1st and 2nd heaters as a fixing heater of said fixing assembly, The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, this -- with 1st and 2nd switching means to control switching of the 1st and 2nd switching means When it falls from the temperature as which the temperature detected by temperature detection

means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand, The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. It is characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.

[0026] In this image formation equipment, said the 1st heater and 2nd heater differ in distribution of exoergic reinforcement preferably.

[0027]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail.

[0028] It is as having mentioned above with reference to drawing 1 and drawing 2 about the outline configuration of the fixing assembly to which this invention is applied. That is, the light is made to switch on by turns on the principle of two heaters, the Maine heater 4 as a fixing heater, and the subheater 5, and the temperature distribution on a heater roller front face are made to equalize by adjusting the lighting time amount of each heater.

[0029] Although the energization pattern to both the heaters shown in drawing 3 is not based on this invention, the meaning of using two heaters is briefly explained using this energization pattern.

[0030] At the time of standby without ****, as compared with the subheater 5, energization of the Maine heater 4 is short to the appearance shown in drawing 3 , and mutual lighting of both the heaters is carried out. Moreover, it is at the **** time, and in the case of the form of small size, since the latent heat near the center of a heater roller is taken, lighting time amount of the Maine heater 4 is lengthened. thus, the time of standby -- every modes at the time of a copy etc. -- mutual lighting time amount -- changing -- the heat distribution on a heater roller -- homogeneity -- carrying out -- making -- especially -- the case of small size ****** -- a part for the non-paper-feed-section on a heater roller -- that is, (part near both sides), an unnecessary temperature up is prevented and damage by the fault temperature up of the bearing of a heater roller edge or a drive gear part is prevented.

[0031] With the gestalt of this operation, it is going to obtain a result equivalent to exoergic control of such two heaters, inhibiting rapid fluctuation of an average current.

[0032] An example of "wave number control" by this invention is shown in drawing 6 . This is carried out to the rush current section of a halogen heater. It is the standup section just behind Heater ON, on the average, the rush current section is worn so that a current may increase gradually, and its

** is good. Therefore, in this example, it starts from the Maine heater ON and a part for 1 time of the half-wave length is periodically energized to the appearance shown first at Period a at three half periods (this is called "1/3 half wave"). Next, as shown at Period b, a part for 2 times of the half-wave lengths is energized periodically at three half periods (this is called "2/3 half wave"). Then, only required time amount may energize the Maine heater by the perimeter term (this is called a "perimeter term".). It does not illustrate. Then, although the Maine heater 4 is switched off and energization of only the subheater 5 is continued, the period e of a perimeter term without infanticide comes first similarly the period c of 1/3 half wave next the period d of 2/3 half wave, and after that.

[0033] namely, this -- starting -- the time -- an average current -- being gradual (here three-stage) -- I hear that it changes and goes in the direction which becomes large one by one from the smaller one, and is finally made to shift to a perimeter term, and it is. In other words, in order that it thins out by the 2 half-wave length among 3 half-wave-length periods since there is most rush current (Period a or Period c), and it may be the place whose heater wires got warm for a while after that and the rush current may also decrease, it thins out by I half-wave length among 3 half-wave-length periods at the beginning of starting (Period b or Period d). And finally it will be said that it changes to the perimeter term impression with zero infanticide.

[0034] Here, a reason with desirable performing wave number infanticide on the basis of 3 half-wave length periods is explained. For example, if it sees on the basis of the 2 half-wave lengths (one usual period), and it will thin out by the 1 half-wave length from now on, it will become the same dc component as a half-wave rectification wave. Now it becomes direct-current lighting and such a drive is not recommended in a halogen heater. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the character called CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, thinking, the shortest periods, i.e., 3 half-wave length periods, other than 2 half-wave lengths, will say that it is the most appropriate. In fact, in infanticide of this 3 half-wave-length period, when lighting was actually connected and CHIRATSUKI was observed, most feeling of CHIRATSUKI was not sensed experimental.

[0035] However, since effectiveness is conventionally accepted also by infanticide with a period longer than 3 half-wave length periods, this invention does not eliminate this so that it may mention later.

[0036] Next, the mitigation approach of current change (P3 in drawing 3 , P4 section) produced at the time of two halogen heater changes, i.e., the change on another side from one side of the Maine heater 4 and the subheater 5, is

described.

[0037] Conventionally, the periodic change of 2 heaters was performed to the appearance shown in drawing 3 the comparatively big period (hundreds mSec(s) - number Sec extent) so that other one side might be told to one degree. This invention performs this change by the view of making it even a limit early.

[0038] The approach of changing in the gestalt of this operation is shown in drawing 7 . First, as shown in a condition M1, half-wave length energization of the Maine heater 4 is carried out, and the 2 half-wave lengths following it repeat control of energizing only the sub heater 5 as shown in a condition S2. The current variation by two heater changes serves as a form finely decomposed for every 3 half-wave length periods as the synthetic current carried out in this way is shown in condition M1+S2. Since it is generated in a minute time interval, the line voltage variation by fluctuation of 3 half-wave length periods is not sensed as CHIRATSUKI, such as lighting, as a matter of fact. If actually adapted in such a view, the change of two heaters conventionally it was shown in drawing 8 , if the subheater 5 was carrying out to the Maine heater 4 by the repeat of continuous half wave (S3) impression of Ns individual after continuous half wave (M3) impression of Nm individual like The heater change for every 3 half-wave length periods of this and equivalence It becomes the pattern which was shown in drawing 9 and which compounds energization (S2 in drawing 7 condition) like by the 2 half-wave lengths in 1 half-wave-length energization in 3 half-wave lengths of the Maine heater 4 (M1 in drawing 7 condition), and 3 half-wave lengths of a subheater, i.e., the energization pattern shown in M1+S2 condition of drawing 7 . This energization pattern is a part for the half-wave length of 2 Ns-Nm individual (A section in drawing 9 > it continues.).

[0039] Next, the pattern which compounds 2 half-wave-length energization (M2 in drawing 7 R> 7 condition) of the Maine heater 4 and 1 half-wave-length energization (SI condition in drawing 7) of the subheater 5, i.e., the energization pattern shown in M2+S1 condition of drawing 7 , performs half-wave length part impression (the B section in drawing 9) of 2 Nm-Ns individual. Such a repeat of the inside A of drawing 9 and the B section is equivalent to the conventional change pattern (drawing 8 R> 8). A repeat period when the reason puts the inside A and B of (1) drawing 9 at one period is a part for the half-wave length of a Nm+Ns individual, and be conventionally the same as the case of a pattern (drawing 8).

[0040] (2) It of Nm and the subheater 5 is Ns, and that of the number of all the impression half waves of the Maine heater 4 of the inside A of drawing 9 and B circles conventionally the same as that of the number of energization half waves in 1 period of a pattern.

[0041] Conventionally, as compared with impression of a pattern, the calorific value of each heater is clearly more nearly equal than (3), (1), and (2), if it sees the whole period.

[0042] Furthermore, although it already said that an idea is advanced and the fluctuation in 3 half-wave length periods in [A] drawing 9 and inside B does not become a problem, the average current difference of the A section in the said drawing and the B section becomes a problem. However, if this amount is evaluated, the average current of A circles will serve as Im(1/3)+(2/3) Is, and the average current of B circles will serve as Im(2/3)+(1/3) Is. Therefore, the difference of Both A and B part is ((1/3) Im+(2/3) Is)-(2/3) (Im+(1/3) Is) = (1/3) (Is-Im).

It turns out that it is one third a next door and in conventional. (The stationary current value when impressing Im here a Maine heater 4 HE perimeter term and Is are taken as it of subHITAHE.) The time of being 2 Nm<=Ns is considered by the above-mentioned case of being special. In this case, the number of half waves of the B section of drawing 9 becomes negative. Then, as shown in drawing 10 , the 3Nm half-wave length part subheater 5 is made S2 condition impression, and the Maine heater 4 adds the wave made M1 condition impression, and impresses S tri-state of only the subheater 5 by the half wave (Ns-2Nm) after that. Even if it considers this case, a repeat period is T=Nm+Ns (number of a half wave), and it by which the number of half waves impressed to the Maine heater 4 in that period T is impressed to Nm and a subheater is Ns, and is not different from the time of the conventional change. furthermore, Ain drawing I0' and B' -- the average current difference between the sections -- ((1/3) Im+(2/3) Is)-Is= (1/3) (Im-Is)

It turns out that it becomes and has become one third in conventional (drawing 8).

[0043] What is necessary is just to think the same way in 2 Ns<=Nm. That is, although not illustrated, A' section in drawing 10 is considered to be S1+M2 condition, and B' section is considered to be M tri-state. Moreover, the number of half waves of A' section at this time is set to 3Ns(es), and the number of half waves of B' section is set to Nm-2Ns. A' in this case, and B' -- the difference of the average current between the sections -- ((1/3) Is+(2/3) Im)-Im= - (1/3) (Im-Is)

Although a next door and a sign are reversed, it turns out too that the absolute value of a current difference is one third in conventional.

[0044] At saying that it rises from the condition that the average current is low, by thinning out a wave in the period of the 3 half-wave length with the gestalt of this operation in short at the time of heater starting, and the time of a heater change Within the period of three half waves, if the Maine heater 4 and the subheater 5 are switched at a rate of one half wave and two half waves (I period) following it The source-effect frequency caused by the

current difference between both heaters becomes high, and it can be said that CHIRATSUKI, such as lighting connected to the power source, uses as a result what no longer sensing for people's eyes.

[0045] Drawing 11 is a circuit diagram for realizing "wave number control" mentioned above.

[0046] The inside of this drawing and TH are temperature sensors (it is 6in drawing I>, and this is connected to resistance R1 and that partial pressure potential is inputted into analog input terminal A/D in CPU.), such as a thermistor which detects the temperature of a heater roller (1 in drawing 1). Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse (refer to drawing 13) corresponding to the zero crossing point of an AC-power-supply electrical potential difference is inputted into the INT input terminal of CPU. This zero cross pulse is generated by a photo coupler PC 1 and Comparator COM based on the alternating-voltage input of a power source.

[0047] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signals OUT1 and OUT2 which make the Maine heater 4 and the subheater 5 turn on to predetermined timing immediately after this zero cross signal falling, respectively are outputted.

[0048] For example, when OUT1 output is H level, the transistor TR1 was set to OFF and the luminescence side of phot triac PT1 has gone out. Since a phot triac is also OFF the light-receiving side of PT1 and the gate current of a triac T1 does not flow, a triac T1 will be in an OFF condition, and the Maine heater 4 will be switched off. In addition, in the gestalt of this operation, a transistor TR1, phot triac PT1, and a triac T1 constitute a "switching means."

[0049] On the contrary, when OUT1 is L level, actuation contrary to **** is carried out, a transistor TR1 turns on the light emitting diode of ON and phot triac PT1, and a phot triac turns it on a light-receiving side. Since the light-receiving side of PT1 flows, the gate current the ** style was carried out [gate current] by resistance R2 or R4 is supplied to the gate of a triac T1. Therefore, a triac T1 is flowed through it and turns on the Maine heater 4.

[0050] Connection of the resistance R6 and the capacitor C1 which were connected to juxtaposition at the triac T1 is the so-called snubber circuit, and when there is an abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that a triac T1 turns on independently (the same is said of resistance R7 and a capacitor C2).

[0051] The flow of OUT2 output which controls lighting of the subheater 5 is the same as the above.

[0052] In the above, the example of the control performed by the explained circuit is explained. Here, although two energization patterns at the time of the change of the Maine heater 4 and the subheater 5 were made into condition A' of drawing 10 , and the thing corresponding to B', according to the object to apply, it can consider as the combination of another energization pattern as shown in drawing 9 .

[0053] Like, when the signal corresponding to the CPUA/D input value in drawing 11 , i.e., the temperature of the heater roller I, shown in drawing 12 has exceeded from target temperature, both the Maine heater 4 and the subheater 5 are OFF (when roller temperature is high). Moreover, like, when less, heater lighting control is carried out in the form which was shown in drawing 12 and which repeats condition a->b->c->d->e to f->e->f->e until roller temperature exceeds a target temperature value. The condition a of these is in M1 energization (1 half-wave length ON in 3 half-wave lengths) condition of the Maine heater 4 shown in drawing 7 like mentioned above, and the subheater 5 is OFF. The Maine heaters 4 are [M2 energization (S2 wave in drawing 7) and the subheater 5 of Condition b] OFF. Conditions c are the Maine heater OFF and the subheater five S1. The Maine heaters 4 of Condition d are OFF and the subheater five S2.

[0054] Thus, current change of each heater to the rush current is made to ease in the Condition a, b, c, and d. Since it is the same as the contents shown in drawing 6 about this, it is as having already explained. Speaking of the repeat of the conditions e and f after it, the Maine heater 4 of Condition e is OFF, and the subheater 5 is the perimeter term ON (S3). The Maine heater 4 of Condition f is synthetic energization of the subheater five S2 in MI energization. This pattern is as it having been the same as that of the pattern shown in drawing 7 , and having also already explained this. In short, this is actuation for reducing change current change produced at the time of the change of the Maine heater 4 and the subheater 5.

[0055] The flow chart with which an example of the software procedure for realizing above-mentioned control is expressed to drawing 14 is shown.

[0056] It already described that the zero cross pulse shown in drawing 13 is given to the interruption input INT to CPU (drawing 11). By falling of this zero cross pulse, interruption actuation starts the processing in CPU and the procedure shown in the flow of drawing 14 is performed.

[0057] First, when an A/D input value is higher than target temperature, processing flows to the N side by decision S141, and each initial value 0 is set to Counters a, b, c, d, e, and f (S142). Moreover, 1 is respectively set to OUT1 and OUT2 (S143), and both the Maine heater 4 and the subheater 5 are turned off by this. Counters a, b, c, d, e, and f are counters which determine each duration of the conditions a, b, c, d, e, and f at the time of the heater ON shown in drawing 12 , and they are managed with the number

of zero cross pulses, i.e., the number of power-source half waves.

[0058] As mentioned above, although processing when roller temperature is higher than a target was described, if the value (temperature is low) than which the A/D input value was less from target temperature is shown, whenever interruption starts, it will judge within [S141] a flow, and processing will flow to the Y side shortly. At the time, I is added to the infanticide counter TO (S144). Whenever this infanticide counter TO passes this part of a flow by 0->1->2->0->1->2 and interruption, a condition continues the round of the condition of three one progress. When a counter value is set to 3, he is trying to return to initial value 0 by decision S145 (S146). This counter TO is processed [subsequent] and the duty of the directions pointer of of which location in 3 half-wave lengths to point out the half-wave length is achieved.

[0059] By decision S147, the condition of a counter is seen, if the default value A defined beforehand is not reached, namely, if it is in a condition in drawing 1212 , processing will flow to the N side and 1 ********** of a counters will be carried out (S138). Default value A is the number of a half wave [in / here / Condition a] (the same about other default value mentioned later). Next, by decision S149, the value of the above-mentioned infanticide counter TO is checked. If this value is 0, the Maine heater 4 is turned on (S150), and if it is the other values 1 or 2, the Maine heater 4 and the subheater 5 will be made into an OFF condition (S151).

[0060] It is at the time when heater temperature is lower than target temperature, and if the infanticide counter TO goes round (0->I->2->0-> ...) and a counter has not reached the default value A, the decision section S149 will be passed each time, and the Maine heater 4 will be periodically turned on by I half wave in three half waves at each time when falling of a zero cross pulse starts an INT input. In the decision section S149, it can be said that the energization condition M1 shown in drawing 7 is made. If a counter reaches default value A, it will end the condition a which showed in drawing 12 , and will shift to Condition b. Namely, if the condition of b counter is checked within [S152] a flow and the default value B is not reached, processing flows to the N side, I count-up of b counter is done (S153), it thins out in decision S154, and the value of Counter TO turns on the Maine heater 4 only at the time of 0 or 1 (S155, S156). This can be said to be having realized the energization condition M2 shown in drawing 7 .

[0061] as mentioned above, if it comes out so and is, c counter will be counted up one time by decision S158, it sees whether in the decision section S157, it is in c condition in drawing 12 similarly, the infanticide counter TO is seen (S159), when the infanticide counter TO is 0, only the sub heater 5 is turned on and S1 condition (inside of drawing 7) is realized (S160, S161). And in the following decision S162, d condition is judged and only five is made intoSsubheater 2 condition by decision S164 after 1 count-up (S163) of d counter (S165, S166). Furthermore, in the following decision S167, e condition is judged and let only the subheater 5 be S tri-state after 1 count-up (S168) of e counter (S169).

[0062] Above, a, b, c and d in drawing 12 , and e condition are completed. That is, it means ending a series of standup section sequences shown in drawing 6 .

[0063] In the following decision S170, it judges whether it is in f condition in drawing 12 . While f counter does not reach the default value F, processing flows to the N side, counts up f counter one time (S171), is thinned out in decision S172, checks Counter TO, if the value is 0, turns on only the Maine heater 4 (S174), and turns on only the subheater 5 except it (S173). It will be in a Maine heater Ml condition and the energization condition of refer to [of the form where subheater S2 condition was compounded] the inside of M1+S2< drawing 7 as a result.

[0064] Moreover, when this f counter reaches default value F, processing flows to the Y side by decision S170, and initial value 0 is re-set to e counter and f counter. consequently -- since default value attainment of e counter of decision S167 will be canceled in the next INT interruption -- once again -- the e condition 5, i.e., a subheater, -- ON (S tri-state) -- becoming -- f->e->f-> ... and these 2 conditions will be repeated.

[0065] Thus, it was shown that the lighting condition of the heater shown in drawing 12 is realizable.

[0066] In addition, after an a-f counter sets up those default value A, B, C, D, E, and F as initial value unlike the above, you may make it investigate whether each counter value amounted to 0 by carrying out the subtrahend.

[0067] According to the gestalt of the above operation, the following exceptional effectiveness is acquired.

[0068] (1) Control hardware becomes comparatively simple. For example, as a means to control the heater current, although a phase control method is generally held like, it is necessary to generate the pulse which specifies the phase angle (time amount in a time interval sufficiently shorter than the time amount of the half-wave length) which was mentioned above, and which should set up a timer from the zero crossing point of supply voltage in this case, and should turn on a heater. These have the fault that hardware, such as the complexity of the control [itself] and a timer style, must be prepared. If it is "wave number control" like this invention, since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setup and starting, decreases that much.

[0069] (2) Since the heater current is impressed from a zero cross origin in "wave number control", I hear that other advantages when comparing with

phase control do not almost have the current change of a frequency with the high order power line period on power-source Rhine, and generating of the so-called power-source higher harmonic, and there are. Usually, although it was necessary for the heater and the serial to insert a mass inductance (choke coil) in order to press down generating of such a power-source higher harmonic wave, this had become the cause in which invites the cost rise by addition of an excessive electrical part, and the request of reservation of the installation bars miniaturization of a machine.

[0070] Above, although the example of a type about "wave number control" of this invention was shown, deformation of the following forms is also considered.

[0071] The example for easing the rush current was shown in drawing 6 , for example, ****** referred to as reducing the magnitude of current variation too even if there are no conditions b and d in this and it is the shift from 1/3 half wave to a perimeter term wave -- it has fixed effectiveness. Similarly, there are no conditions a or c and, only also in Conditions b or d, the same thing can be said.

[0072] This invention contains ** in all the combination that can reduce an average current value by thinning out by the 1 or 2 half-wave lengths, and can reduce the magnitude of the rush current out of the period of 3 half-wave length units in short at the time of this starting just.

[0073] Although the example in mutual lighting of the Maine heater 4 and the subheater 5 and the so-called flicker ring lighting was shown in drawing 9

TECHNICAL FIELD

[Field of the Invention] This invention relates to image formation equipments, such as an electrostatic copying machine and a printer, and relates to the heater control approach of reducing fluctuation of the current which includes the rush current by ON/OFF of the fixing heater especially.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of fixing heater, and there is generating of the very big rush current at the time of that ON. Especially when temperature of a halogen heater the property top of a halogen heater and own is high, the resistance is large, and resistance becomes small when low. Usually, since a halogen heater is turned on when heater temperature becomes lower than the temperature defined beforehand, the big rush current will flow immediately after lighting.
[0003] A voltage variation explanatory view is shown in drawing 5 . Generally, when a supply power source is seen from a power-receptacle side, the comparatively small source impedance (Rs) 7 exists. For this reason, when the consumed electric current I of the device (here copying machine) connected to the power source changes suddenly a lot, fluctuation of supply voltage V occurs and the amount of [**I then] rapid source effect can estimate the current change with that rapid magnitude as **V=Rsx**I. For example, if the luminaire 9 is connected to this plug socket line, rapid voltage variation will serve as CHIRATSUKI of lighting, and will appear.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] Since according to this invention it cannot be based on phase control but the rapid current change by the halogen heater can be reduced, control hardware can be simplified comparatively. Moreover, since the heater current is impressed from a zero cross origin, most generating of the power-source higher harmonic on power-source Rhine can be abolished.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Here, the technical problem of this invention is explained in relation to the configuration of a concrete fixing assembly.

[0005] Drawing 1 is a schematic diagram of a fixing assembly with which this invention is applied, 1 in this expresses a heater roller and 2 expresses a pressurization roller. Thermal melting arrival of the toner image can be carried out on a form 3 by passing the form 3 with which the toner image was developed between both this roller 1 and 2. In the heater roller 1, it is equipped in the form where the Maine heater 4 and the subheater 5 were illustrated.

[0006] That is, as shown in drawing 2 , the exoergic intensity distribution of the Maine heater 4 have a peak near a center (drawing 2 A), and, on the other hand, the subheater 5 has a peak in a both-ends side (drawing 2 B). These two heaters are made to turn on by turns, and the temperature distribution on a roller front face are made to equalize by adjusting the lighting time amount of each heater (drawing 2 C).

[0007] Although drawing 3 shows the energization current wave form of HITAHE at the time of standby, P1 is a part with a big current change in this. As mentioned above in drawing 5 , this current change produced the voltage variation of the supply power source itself, and has caused evils, such as CHIRATSUKI, such as lighting connected to the same power source. The social request that the voltage variation by current change of such a device will be reduced in recent years has become strong.

[0008] Although this invention offers the approach for reducing the rapid current change by the halogen heater used for the fixing assembly of image formation equipment, it is specifically easing the following rapid current change parts shown in drawing 3 .

[0009] 1 The rush current section of a halogen heater (P1 in drawing 3 , P2 section)

2 The current variation section when changing a heater by turns by the fixing assembly of 2 heater configurations (P3, P4 in drawing 3)

In order to solve such a trouble, energization of HITAHE by phase control as shown in drawing 4 can be considered. What is necessary is just to expand gradually the resistance welding time in 1 half-wave length to rapid voltage variation prevention like [at the time of rush current generating just behind Heater ON] to tm1, tm2, tm3, —, tmc first in the form shown, for example in the energization wave of Maine heater 4 HE in drawing 4 , since what is necessary is just to enlarge effectual magnitude of an electrical potential difference gradually. It is similarly referred to as ts1, ts2, ts3, —, tsc about the subheater 5. tmc which is equivalent to the steady state energization phase angle of the Maine heater 4 in this, and tsc of the subheater 5 are constant value.

[0010] Since the energization power of the Maine heater 4 in this case is Tm/T and a subheater is the rate of Ts/T when this value is returned and considered to the change wave in drawing 3 , it is possible to adjust tmc and tsc according to this value.

[0011] It is also possible to carry out moderate current change near the fact and an ideal by such configuration. However, the following faults also exist in this approach.

[0012] The complexity on control of that the hardware is complicated and those setup, starting, etc., such as a timer style for deciding 1 and a phase angle (namely, time amount, such as **** tmc and tsc), is also considered to become high similarly.

[0013] To the area (regional difference (50Hz and 60Hz)) where 2 differs from a power line period, another setup must be carried out respectively and the complicatedness on the management to the carving is produced.

[0014] Since energization of HITAHE is turned on in the middle in not a zero cross origin but the half-wave length so that clearly even if it sees 3 and drawing 4 , the evil of generating of a higher-harmonic current is produced. Generating this higher-harmonic current by the high order wave (several times to dozens times) of a power line period, this does active jamming as other device HE connected through the feeder, and a noise, and causes malfunction and failure. Therefore, in the case of phase control, in order to reduce this power-source higher-harmonic-wave current, correspondence of inserting a mass choke coil is needed separately.

[0015] This invention proposes how this is conquerable in view of such a trouble. That is, this invention is not based on phase control, but the image formation equipment which adopted the control approach of a fixing heater and this which can reduce the rapid current change by the fixing heater is offered.

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MEANS

[Means for Solving the Problem] After the control approach of the fixing heater by this invention adopts the control which thins out 1 of them, or the wave for two or more half-wave lengths by making into a period a part for the 3 half-wave lengths which the AC-power-supply electrical potential difference impressed to a fixing heater follows at least and impresses the infanticide wave by said infanticide control to said fixing heater immediately after impression initiation of the AC-power-supply electrical potential difference to said fixing heater, it is characterized by to shift to the wave-like impression without infanticide.

[0017] By this, generating of the rush current immediately after impression initiation of the AC-power-supply electrical potential difference to a fixing heater can be prevented. Moreover, since it is not based on phase control but the heater current is impressed from a zero cross origin, while abolishing most generating of the power-source higher harmonic on power-source Rhine, control hardware can be simplified comparatively.

[0018] By making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential difference, impression of a term is performed two or more rounds as two infanticide, and, specifically, it shifts to impression with zero infanticide after that.

[0019] According to other standpoints, after the approach of this invention changes the number of infanticide from size to smallness immediately after impression initiation of said AC-power-supply electrical potential difference, it is considered as zero infanticide.

[0020] For example, by making a part for the 3 half-wave length into a period, immediately after impression initiation of said AC-power-supply electrical potential difference, impression of a term is performed two or more rounds as two infanticide, subsequently, impression of a term is performed two or more rounds as 1, and the number of infanticide is shifted to impression with zero infanticide after that.

[0021] When said fixing heater consists of the 1st heater and 2nd heater, in case it energizes by turns to said the 1st heater and 2nd heater, at the 1st heater, the wave for the 1 half-wave length of the 3 half-wave lengths of one period or the 2 half-wave lengths is thinned out and energized by making a part for the 3 continuous half-wave lengths into a period, and the wave only for the half-wave length thinned out at the 1st heater is impressed to the 2nd heater.

[0022] In this case, the 1st energization pattern to such 1st and 2nd heaters and the 2nd energization pattern which made reverse relation of the 1st and 2nd heaters are changed by turns.

[0023] As control specifically equivalent to the control which repeats continuation impression of the half-wave length of Nm individual to the 1st heater, and continuation impression of the half-wave length of Ns individual to the 2nd heater by turns It repeats a part for the half-wave length of 2 Ns-Nm individual and said 1st energization pattern performing energization to the 1st and 2nd heaters, and performing energization to the 1st and 2nd heaters subsequently by the energization pattern of the account 2nd of a half-wave length quota of 2 Nm-Ns individual by turns.

[0024] How to change the 1st energization pattern to the 1st and 2nd above-mentioned heaters and energization with one zero infanticide of the 1st and 2nd heaters by turns as an option is also considered.

[0025] The image formation equipment by this invention is image formation equipment which has the fixing assembly which fixes a toner image on a form. The 1st and 2nd heaters as a fixing heater of said fixing assembly, The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, this -- with 1st and 2nd switching means to control switching of the 1st and 2nd switching means When it falls from the temperature as which the temperature detected by temperature detection means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand, The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. It is characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.

[0026] In this image formation equipment, said the 1st heater and 2nd heater differ in distribution of exoergic reinforcement preferably.

[0027]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of

this invention is explained to a detail.

[0028] It is as having mentioned above with reference to drawing 1 and drawing 2 about the outline configuration of the fixing assembly to which this invention is applied. That is, the light is made to switch on by turns on the principle of two heaters, the Maine heater 4 as a fixing heater, and the subheater 5, and the temperature distribution on a heater roller front face are made to equalize by adjusting the lighting time amount of each heater.

[0029] Although the energization pattern to both the heaters shown in drawing 3 is not based on this invention, the meaning of using two heaters is briefly explained using this energization pattern.

[0030] At the time of standby without ****, as compared with the subheater 5, energization of the Maine heater 4 is short to the appearance shown in drawing 3 , and mutual lighting of both the heaters is carried out. Moreover, it is at the **** time, and in the case of the form of small size, since the latent heat near the center of a heater roller is taken, lighting time amount of the Maine heater 4 is lengthened. thus, the time of standby -- every modes at the time of a copy etc. -- mutual lighting time amount -- changing -- the heat distribution on a heater roller -- homogeneity -- carrying out -- making -- especially -- the case of small size ****** -- a part for the non-paper-feed-section on a heater roller -- that is, (part near both sides), an unnecessary temperature up is prevented and damage by the fault temperature up of the bearing of a heater roller edge or a drive gear part is prevented.

[0031] With the gestalt of this operation, it is going to obtain a result equivalent to exoergic control of such two heaters, inhibiting rapid fluctuation of an average current.

[0032] An example of "wave number control" by this invention is shown in drawing 6 . This is carried out to the rush current section of a halogen heater. It is the standup section just behind Heater ON, on the average, the rush current section is worn so that a current may increase gradually, and its ** is good. Therefore, in this example, it starts from the Maine heater ON and a part for 1 time of the half-wave length is periodically energized to the appearance shown first at Period a at three half periods (this is called "1/3 half wave"). Next, as shown at Period b, a part for 2 times of the half-wave lengths is energized periodically at three half periods (this is called "2/3 half wave"). Then, only required time amount may energize the Maine heater by the perimeter term (this is called a "perimeter term".). It does not illustrate. Then, although the Maine heater 4 is switched off and energization of only the subheater 5 is continued, the period e of a perimeter term without infanticide comes first similarly the period c of 1/3 half wave next the period d of 2/3 half wave, and after that.

[0033] namely, this -- starting -- the time -- an average current -- being gradual (here three-stage) -- I hear that it changes and goes in the direction which becomes large one by one from the smaller one, and is finally made to shift to a perimeter term, and it is. In other words, in order that it thins out by the 2 half-wave length among 3 half-wave-length periods since there is most rush current (Period a or Period c), and it may be the place whose heater wires got warm for a while after that and the rush current may also decrease, it thins out by I half-wave length among 3 half-wave-length periods at the beginning of starting (Period b or Period d). And finally it will be said that it changes to the perimeter term impression with zero infanticide.

[0034] Here, a reason with desirable performing wave number infanticide on the basis of 3 half-wave length periods is explained. For example, if it sees on the basis of the 2 half-wave lengths (one usual period), and it will thin out by the 1 half-wave length from now on, it will become the same dc component as a half-wave rectification wave. Now it becomes direct-current lighting and such a drive is not recommended in a halogen heater. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the character called CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, thinking, the shortest periods, i.e., 3 half-wave length periods, other than 2 half-wave lengths, will say that it is the most appropriate. In fact, in infanticide of this 3 half-wave-length period, when lighting was actually connected and CHIRATSUKI was observed, most feeling of CHIRATSUKI was not sensed experimental.

[0035] However, since effectiveness is conventionally accepted also by infanticide with a period longer than 3 half-wave length periods, this invention does not eliminate this so that it may mention later.

[0036] Next, the mitigation approach of current change (P3 in drawing 3 , P4 section) produced at the time of two halogen heater changes, i.e., the change on another side from one side of the Maine heater 4 and the subheater 5, is described.

[0037] Conventionally, the periodic change of 2 heaters was performed to the appearance shown in drawing 3 the comparatively big period (hundreds mSec(s) - number Sec extent) so that other one side might be told to one degree. This invention performs this change by the view of making it even a limit early.

[0038] The approach of changing in the gestalt of this operation is shown in drawing 7 . First, as shown in a condition M1, half-wave length energization of the Maine heater 4 is carried out, and the 2 half-wave lengths following it repeat control of energizing only the sub heater 5 as shown in a condition S2. The current variation by two heater changes serves as a form finely decomposed for every 3 half-wave length periods as the synthetic current

carried out in this way is shown in condition M1+S2. Since it is generated in a minute time interval, the line voltage variation by fluctuation of 3 half-wave length periods is not sensed as CHIRATSUKI, such as lighting, as a matter of fact. If actually adapted in such a view, the change of two heaters conventionally it was shown in drawing 8 , if the subheater 5 was carrying out to the Maine heater 4 by the repeat of continuous half wave (S3) impression of Ns individual after continuous half wave (M3) impression of Nm individual like The heater change for every 3 half-wave length periods of this and equivalence It becomes the pattern which was shown in drawing 9 and which compounds energization (S2 in drawing 7 condition) like by the 2 half-wave lengths in 1 half-wave-length energization in 3 half-wave lengths of the Maine heater 4 (M1 in drawing 7 condition), and 3 half-wave lengths of a subheater, i.e., the energization pattern shown in M1+S2 condition of drawing 7 . This energization pattern is a part for the half-wave length of 2 Ns-Nm individual (A section in drawing 9 > it continues.). [0039] Next, the pattern which compounds 2 half-wave-length energization (M2 in drawing 7 R> 7 condition) of the Maine heater 4 and 1 half-wave-length energization (SI condition in drawing 7) of the subheater 5, i.e., the energization pattern shown in M2+S1 condition of drawing 7 , performs half-wave length part impression (the B section in drawing 9) of 2 Nm-Ns individual. Such a repeat of the inside A of drawing 9 and the B section is equivalent to the conventional change pattern (drawing 8 R> 8). A repeat period when the reason puts the inside A and B of (1) drawing 9 at one period is a part for the half-wave length of a Nm+Ns individual, and be conventionally the same as the case of a pattern (drawing 8).

[0040] (2) It of Nm and the subheater 5 is Ns, and that of the number of all the impression half waves of the Maine heater 4 of the inside A of drawing 9 and B circles conventionally the same as that of the number of energization half waves in 1 period of a pattern.

[0041] Conventionally, as compared with impression of a pattern, the calorific value of each heater is clearly more nearly equal than (3), (1), and (2), if it sees the whole period.

[0042] Furthermore, although it already said that an idea is advanced and the fluctuation in 3 half-wave length periods in [A] drawing 9 and inside B does not become a problem, the average current difference of the A section in the said drawing and the B section becomes a problem. However, if this amount is evaluated, the average current of A circles will serve as Im(1/3)+(2/3) Is, and the average current of B circles will serve as Im(2/3)+(1/3) Is.

Therefore, the difference of Both A and B part is ((1/3) Im+(2/3) Is)-(2/3) (Im+(1/3) Is) = (1/3) (Is-Im).

It turns out that it is one third a next door and in conventional. (The stationary current value when impressing Im here a Maine heater 4 HE perimeter term and Is are taken as it of subHITAHE.) The time of being 2 Nm<=Ns is considered by the above-mentioned case of being special. In this case, the number of half waves of the B section of drawing 9 becomes negative. Then, as shown in drawing 10 , the 3Nm half-wave length part subheater 5 is made S2 condition impression, and the Maine heater 4 adds the wave made M1 condition impression, and impresses S tri-state of only the subheater 5 by the half wave (Ns-2Nm) after that. Even if it considers this case, a repeat period is T=Nm+Ns (number of a half wave), and it by which the number of half waves impressed to the Maine heater 4 in that period T is impressed to Nm and a subheater is Ns, and is not different from the time of the conventional change. furthermore, Ain drawing I0' and B' -- the average current difference between the sections -- ((1/3) Im+(2/3) Is)-Is= (1/3) (Im-Is)

It turns out that it becomes and has become one third in conventional (drawing 8).

[0043] What is necessary is just to think the same way in 2 Ns<=Nm. That is, although not illustrated, A' section in drawing 10 is considered to be S1+M2 condition, and B' section is considered to be M tri-state. Moreover, the number of half waves of A' section at this time is set to 3Ns(es), and the number of half waves of B' section is set to Nm-2Ns. A' in this case, and B' -- the difference of the average current between the sections -- ((1/3) Is+(2/3) Im)-Im= - (1/3) (Im-Is)

Although a next door and a sign are reversed, it turns out too that the absolute value of a current difference is one third in conventional.

[0044] At saying that it rises from the condition that the average current is low, by thinning out a wave in the period of the 3 half-wave length with the gestalt of this operation in short at the time of heater starting, and the time of a heater change Within the period of three half waves, if the Maine heater 4 and the subheater 5 are switched at a rate of one half wave and two half waves (I period) following it The source-effect frequency caused by the current difference between both heaters becomes high, and it can be said that CHIRATSUKI, such as lighting connected to the power source, uses as a result what no longer sensing for people's eyes.

[0045] Drawing 11 is a circuit diagram for realizing "wave number control" mentioned above.

[0046] The inside of this drawing and TH are temperature sensors (it is 6in drawing I>, and this is connected to resistance R1 and that partial pressure potential is inputted into analog input terminal A/D in CPU.), such as a thermistor which detects the temperature of a heater roller (1 in drawing 1). Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse (refer to drawing 13) corresponding to the zero crossing point of an

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AC-power-supply electrical potential difference is inputted into the INT input terminal of CPU. This zero cross pulse is generated by a photo coupler PC 1 and Comparator COM based on the alternating-voltage input of a power source.

[0047] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signals OUT1 and OUT2 which make the Maine heater 4 and the subheater 5 turn on to predetermined timing immediately after this zero cross signal falling, respectively are outputted.

[0048] For example, when OUT1 output is H level, the transistor TR1 was set to OFF and the luminescence side of phot triac PT1 has gone out. Since a phot triac is also OFF the light-receiving side of PT1 and the gate current of a triac T1 does not flow, a triac T1 will be in an OFF condition, and the Maine heater 4 will be switched off. In addition, in the gestalt of this operation, a transistor TR1, phot triac PT1, and a triac T1 constitute a "switching means."

[0049] On the contrary, when OUT1 is L level, actuation contrary to **** is carried out, a transistor TR1 turns on the light emitting diode of ON and phot triac PT1, and a phot triac turns it on a light-receiving side. Since the light-receiving side of PT1 flows, the gate current the ** style was carried out [gate current] by resistance R2 or R4 is supplied to the gate of a triac T1. Therefore, a triac T1 is flowed through it and turns on the Maine heater 4.

[0050] Connection of the resistance R6 and the capacitor C1 which were connected to juxtaposition at the triac T1 is the so-called snubber circuit, and when there is an abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that a triac T1 turns on independently (the same is said of resistance R7 and a capacitor C2).

[0051] The flow of OUT2 output which controls lighting of the subheater 5 is the same as the above.

[0052] In the above, the example of the control performed by the explained circuit is explained. Here, although two energization patterns at the time of the change of the Maine heater 4 and the subheater 5 were made into condition A' of drawing 10 , and the thing corresponding to B', according to the object to apply, it can consider as the combination of another energization pattern as shown in drawing 9 .

[0053] Like, when the signal corresponding to the CPUA/D input value in drawing 11 , i.e., the temperature of the heater roller I, shown in drawing 12 has exceeded from target temperature, both the Maine heater 4 and the subheater 5 are OFF (when roller temperature is high). Moreover, like, when less, heater lighting control is carried out in the form which was shown in drawing 12 and which repeats condition a->b->c->d->e to f->e->f->e until roller temperature exceeds a target temperature value. The condition a of these is in M1 energization (1 half-wave length ON in 3 half-wave lengths) condition of the Maine heater 4 shown in drawing 7 like mentioned above, and the subheater 5 is OFF. The Maine heaters 4 are [M2 energization (S2 wave in drawing 7) and the subheater 5 of Condition b] OFF. Conditions c are the Maine heater OFF and the subheater five S1. The Maine heaters 4 of Condition d are OFF and the subheater five S2.

[0054] Thus, current change of each heater to the rush current is made to ease in the Condition a, b, c, and d. Since it is the same as the contents shown in drawing 6 about this, it is as having already explained. Speaking of the repeat of the conditions e and f after it, the Maine heater 4 of Condition e is OFF, and the subheater 5 is the perimeter term ON (S3). The Maine heater 4 of Condition f is synthetic energization of the subheater five S2 in MI energization. This pattern is as it having been the same as that of the pattern shown in drawing 7 , and having also already explained this. In short, this is actuation for reducing change current change produced at the time of the change of the Maine heater 4 and the subheater 5.

[0055] The flow chart with which an example of the software procedure for realizing above-mentioned control is expressed to drawing 14 is shown.

[0056] It already described that the zero cross pulse shown in drawing 13 is given to the interruption input INT to CPU (drawing 11). By falling of this zero cross pulse, interruption actuation starts the processing in CPU and the procedure shown in the flow of drawing 14 is performed.

[0057] First, when an A/D input value is higher than target temperature, processing flows to the N side by decision S141, and each initial value 0 is set to Counters a, b, c, d, e, and f (S142). Moreover, 1 is respectively set to OUT1 and OUT2 (S143), and both the Maine heater 4 and the subheater 5 are turned off by this. Counters a, b, c, d, e, and f are counters which determine each duration of the conditions a, b, c, d, e, and f at the time of the heater ON shown in drawing 12 , and they are managed with the number of zero cross pulses, i.e., the number of power-source half waves.

[0058] As mentioned above, although processing when roller temperature is higher than a target was described, if the value (temperature is low) than which the A/D input value was less from target temperature is shown, whenever interruption starts, it will judge within [S141] a flow, and processing will flow to the Y side shortly. At the time, I is added to the infanticide counter TO (S144). Whenever this infanticide counter TO passes this part of a flow by 0->1->2->0->1->2 and interruption, a condition continues the round of the condition of three one progress. When a counter value is set to 3, he is trying to return to initial value 0 by decision S145 (S146). This counter TO is processed [subsequent] and the duty of the directions pointer of of which location in 3 half-wave lengths to point out the

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half-wave length is achieved.

[0059] By decision S147, the condition of a counter is seen, if the default value A defined beforehand is not reached, namely, if it is in a condition in drawing 1212 , processing will flow to the N side and 1 ********** of a counters will be carried out (S138). Default value A is the number of a half wave [in / here / Condition a] (the same about other default value mentioned later). Next, by decision S149, the value of the above-mentioned infanticide counter TO is checked. If this value is 0, the Maine heater 4 is turned on (S150), and if it is the other values 1 or 2, the Maine heater 4 and the subheater 5 will be made into an OFF condition (S151).

[0060] It is at the time when heater temperature is lower than target temperature, and if the infanticide counter TO goes round (0->1->2->0-> ...) and a counter has not reached the default value A, the decision section S149 will be passed each time, and the Maine heater 4 will be periodically turned on by 1 half wave in three half waves at each time when falling of a zero cross pulse starts an INT input. In the decision section S149, it can be said that the energization condition M1 shown in drawing 7 is made. If a counter reaches default value A, it will end the condition a which showed in drawing 12 , and will shift to Condition b. Namely, if the condition of b counter is checked within [S152] a flow and the default value B is not reached, processing flows to the N side, 1 count-up of b counter is done (S153), it thins out in decision S154, and the value of Counter TO turns on the Maine heater 4 only at the time of 0 or 1 (S155, S156). This can be said to be having realized the energization condition M2 shown in drawing 7 .

[0061] as mentioned above, if it comes out so and is, c counter will be counted up one time by decision S158, it sees whether in the decision section S157, it is in c condition in drawing 12 similarly, the infanticide counter TO is seen (S159), when the infanticide counter TO is 0, only the sub heater 5 is turned on and S1 condition (inside of drawing 7) is realized (S160, S161). And in the following decision S162, d condition is judged and only five is made intoSsubheater 2 condition by decision S164 after 1 count-up (S163) of d counter (S165, S166). Furthermore, in the following decision S167, e condition is judged and let only the subheater 5 be S tri-state after 1 count-up (S168) of e counter (S169).

[0062] Above, a, b, c and d in drawing 12 , and e condition are completed. That is, it means ending a series of standup section sequences shown in drawing 6 .

[0063] In the following decision S170, it judges whether it is in f condition in drawing 12 . While f counter does not reach the default value F, processing flows to the N side, counts up f counter one time (S171), is thinned out in decision S172, checks Counter TO, if the value is 0, turns on only the Maine heater 4 (S174), and turns on only the subheater 5 except it (S173). It will be in a Maine heater MI condition and the energization condition of refer to [of the form where subheater S2 condition was compounded] the inside of M1+S2< drawing 7 as a result.

[0064] Moreover, when this f counter reaches default value F, processing flows to the Y side by decision S170, and initial value 0 is re-set to e counter and f counter. consequently -- since default value attainment of e counter of decision S167 will be canceled in the next INT interruption -- once again -- the e condition 5, i.e., a subheater, -- ON (S tri-state) -- becoming -- f->e->f-> ... and these 2 conditions will be repeated.

[0065] Thus, it was shown that the lighting condition of the heater shown in drawing 12 is realizable.

[0066] In addition, after an a-f counter sets up those default value A, B, C, D, E, and F as initial value unlike the above, you may make it investigate whether each counter value amounted to 0 by carrying out the subtrahend.

[0067] According to the gestalt of the above operation, the following exceptional effectiveness is acquired.

[0068] (1) Control hardware becomes comparatively simple. For example, as a means to control the heater current, although a phase control method is generally held like, it is necessary to generate the pulse which specifies the phase angle (time amount in a time interval sufficiently shorter than the time amount of the half-wave length) which was mentioned above, and which should set up a timer from the zero crossing point of supply voltage in this case, and should turn on a heater. These have the fault that hardware, such as the complexity of the control [itself] and a timer style, must be prepared. If it is "wave number control" like this invention, since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setup and starting, decreases that much.

[0069] (2) Since the heater current is impressed from a zero cross origin in "wave number control", I hear that other advantages when comparing with phase control do not almost have the current change of a frequency with the high order power line period on power-source Rhine, and generating of the so-called power-source higher harmonic, and there are. Usually, although it was necessary for the heater and the serial to insert a mass inductance (choke coil) in order to press down generating of such a power-source higher harmonic wave, this had become the cause in which invites the cost rise by addition of an excessive electrical part, and the request of reservation of the installation bars miniaturization of a machine.

[0070] Above, although the example of a type about "wave number control" of this invention was shown, deformation of the following forms is also considered.

[0071] The example for easing the rush current was shown in drawing 6 . for

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example, ****** referred to as reducing the magnitude of current variation too even if there are no conditions b and d in this and it is the shift from 1/3 half wave to a perimeter term wave -- it has fixed effectiveness. Similarly, there are no conditions a or c and, only also in Conditions b or d, the same thing can be said.

[0072] This invention contains ** in all the combination that can reduce an average current value by thinning out by the 1 or 2 half-wave lengths, and can reduce the magnitude of the rush current out of the period of 3 half-wave length units in short at the time of this starting just.

[0073] Although the example in mutual lighting of the Maine heater 4 and the subheater 5 and the so-called flicker ring lighting was shown in drawing 9

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram of a fixing assembly with which this invention is applied.

[Drawing 2] It is the graph which shows the exoergic intensity distribution of the Maine heater of the fixing assembly of drawing 1 , and a subheater.

[Drawing 3] It is the timing chart showing an example of the energization condition of the Maine heater of the fixing assembly of drawing 1 , and a subheater.

[Drawing 4] It is a timing chart for explaining energization of HITAHE by phase control.

[Drawing 5] the current of a device -- it is a circuit diagram for following electric and explaining the voltage variation to produce.

[Drawing 6] It is the current wave form Fig. showing an example of the wave number control at the time of heater starting in the gestalt of operation of this invention.

[Drawing 7] It is the current wave form Fig. showing the energization pattern used at the time of the change of the Maine heater in the gestalt of operation of this invention, and a subheater.

[Drawing 8] It is the explanatory view showing how to change the former of the Maine heater and a subheater.

[Drawing 9] It is the explanatory view showing the energization condition of the Maine heater and a subheater in the gestalt of operation of this invention equivalent to drawing 8 .

[Drawing 10] It is the explanatory view showing the modification of the energization condition of the Maine heater of drawing 9 , and a subheater.

[Drawing 11] It is the circuit diagram showing the circuit for realizing the energization condition of the Maine heater and a subheater in the gestalt of operation of this invention.

[Drawing 12] It is the explanatory view of the example of the control

performed by the circuit of drawing 11 .

[Drawing 13] It is the explanatory view of the zero cross pulse of the supply voltage detected in the circuit of drawing 11 .

[Drawing 14] It is the flow chart which shows an example of the interruption processing performed by CPU of drawing 11 .

[Drawing 15] It is the wave form chart showing the modification of the gestalt of operation of this invention.

[Description of Notations]

1 [-- The Maine heater, 5 / -- A subheater, 6 / -- Temperature sensor.] -- A heater roller, 2 -- A pressurization roller, 3 -- A form, 4

[Translation done.]

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 2nd partition of the 6th section
[Publication date] October 5, Heisei 13 (2001. 10.5)

[Publication No.] JP,11-95811,A
[Date of Publication] April 9, Heisei 11 (1999. 4.9)
[Annual volume number] Open patent official report 11-957
[Application number] Japanese Patent Application No. 9-272107
[The 7th edition of International Patent Classification]

G03G 15/20 109
G05F 1/455

[FI]

G03G 15/20 109
G05F 1/455 B

[Procedure revision]
[Filing Date] December 21, Heisei 12 (2000. 12.21)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim 9
[Method of Amendment] Modification
[Proposed Amendment]
[Claim 9] It is image formation equipment which has the fixing assembly which fixes a toner image on a form,
The 1st and 2nd heaters as a fixing heater of said fixing assembly,
The 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively,
A temperature detection means to detect the heater temperature of said fixing heater,
A zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference,
The control means which determines the right or wrong of impression of said supply voltage of a half-wave length unit to said 1st and 2nd heaters in the procedure defined beforehand, and controls said 1st and 2nd switching means one by one based on this decision result at every zero cross by said zero cross detection means when it falls from the temperature as which the temperature detected by said temperature detection means was determined beforehand
Image formation equipment characterized by preparation ******.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0025
[Method of Amendment] Modification
[Proposed Amendment]
[0025] The image formation equipment by this invention is image formation equipment which has the fixing assembly which fixes a toner image on a form, and is a fixing heater of said fixing assembly. **** 1 and the 2nd heater, and the 1st and the 2nd switching means of controlling independently the impression of an AC-power-supply electrical potential difference to these 1st and 2nd heaters, respectively, When it falls from the temperature as which the temperature detected by temperature detection means to detect the heater temperature of said fixing heater, zero cross detection means to detect the zero crossing point of an AC-power-supply electrical potential difference, and said temperature detection means was determined beforehand, The procedure defined beforehand determines the right or wrong of impression of said supply voltage of a half-wave length unit at every zero cross by said zero cross detection means to said 1st and 2nd heaters one by one. It is characterized by having the control means which controls said 1st and 2nd switching means based on this decision result.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0032
[Method of Amendment] Modification
[Proposed Amendment]

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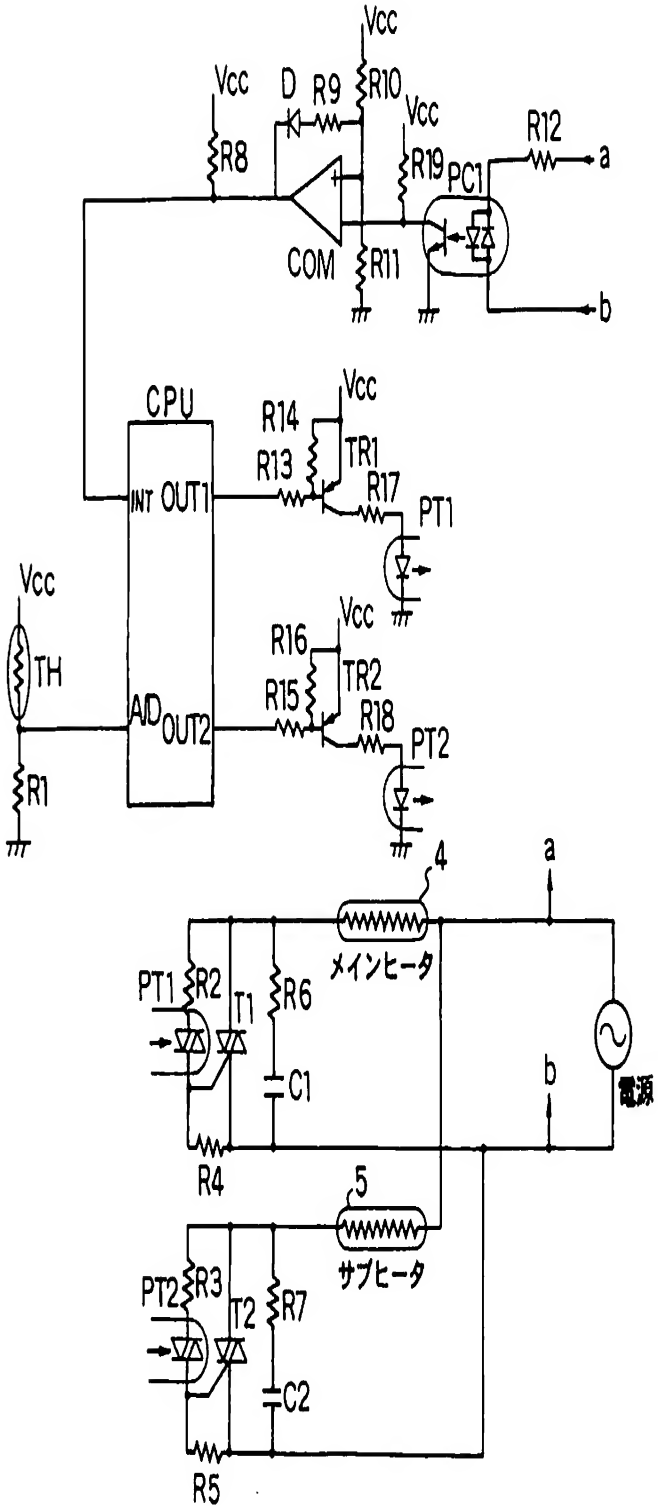
[0032] An example of "wave number control" by this invention is shown in drawing 8. This is carried out to the rush current section of a halogen heater. What is necessary is for the rush current section to be the standup section just behind Heater ON, and just to make it a current increase it gradually on the average. Therefore, in this example, it starts from the Mains heater ON and a part for 1 time of the half-wave length is periodically energized to the appearance shown first at Period a at three half periods (this is called "1/3 half wave"). Next, as shown at Period b, a part for 2 times of the half-wave lengths is energized periodically at three half periods (this is called "2/3 half wave"). Then, only required time amount may energize the Mains heater by the perimeter term (this is called a "perimeter term"). It does not illustrate. Then, although the Mains heater 4 is switched off and energization of only the subheater 5 is continued, the period c of a perimeter term without infanticide comes first similarly the period c of 1/3 half wave next the period d of 2/3 half wave, and after that.

[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0059
[Method of Amendment] Modification
[Proposed Amendment]
[0059] By decision S147, the condition of a counter is seen, if the default value A defined beforehand is not reached, namely, if it is in a condition in drawing 12, processing will flow to the N side and 1 ********** of a counters will be carried out (S148). Default value A is the number of a half wave [in / here / Condition a] (the same about other default value mentioned later). Next, by decision S149, the value of the above-mentioned infanticide counter TO is checked. If this value is 0, the Mains heater 4 is turned on (S150), and if it is the other values 1 or 2, the Mains heater 4 and the subheater 5 will be made into an OFF condition (S151).

[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0063
[Method of Amendment] Modification
[Proposed Amendment]
[0063] In the following decision S170, it judges whether it is in f condition in drawing 12. While f counter does not reach the default value F, processing flows to the N side, counts up f counter one time (S171), is thinned out in decision S172, checks Counter TO, if the value is 0, turns on only the Mains heater 4 (S174), and turns on only the subheater 5 except it (S173). It will be in a Mains heater MI condition and the energization condition of M1+S2 (refer to inside of drawing 7) of the form where subheater S2 condition was compounded, as a result.

[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0064
[Method of Amendment] Modification
[Proposed Amendment]
[0064] Moreover, when this f counter reaches default value F, processing flows to the Y side by decision S170, and initial value 0 is re-set to a counter and f counter. consequently -- since default value attainment of a counter of decision S167 will be canceled in the next INT interruption -- once again -- the a condition 5, i.e., a subheater, -- ON (S tri-state) -- becoming -- f->a->f-> ... and these 2 conditions will be repeated.

[Procedure amendment 7]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 11
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 11]



[Translation done.]